

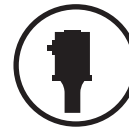
# DUKANE

Intelligent Assembly Solutions

## *iQ* Series

AUTOMATION-CONTROLLED PROBE GENERATORS

## LS



AUTOMATED



HAND PROBE



PRESS

## User's Manual



Dukane Part No. 403-572-03

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**ISO 9001:2008** Products are manufactured in ISO registered facilities.



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This user's manual documents product features, hardware, and controls software available at the time the manual was published.

Printed in the United States of America

Part Number: 403 - 572 - 03

This ultrasonic equipment is manufactured under one or more of the following U.S. Patents:

3,780,926 3,825,481 4,131,505 4,277,710 5,798,599 5,880,580 6,984,921 7,225,965  
7,475,801 and 8,052,816

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# Revision History

Revision Number	Revision Summary	Date
- 00	Original release.	07/10/2008
- 01	System inputs signal description changes. Options, Section 10, expanded. Models added.	08/04/2009
- 02	Rear panel revised. Web address updated. Options, Section 10, revised. Regulatory Agency Compliance statement updated.	06/30/2010
- 03	Added Patent 8,052,816 to Page ii. Added to Section 2 - Health and Safety. General Considerations expanded. Added to Section 6 - Process Control Settings. Programming Examples, Pages 46-48. Updated the Regulatory Agency Compliance statement on Page 92. Added Warnings and Cautions re: Modifications to Operate and E-STOP switches; cable connections; lockout-tagout devices; third party modifications to fixtures; and, lifting the equipment. Added Index. Repaginated as necessary.	03/08/2013

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# SECTION 1

## Introduction

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## General User Information

### Read This Manual First

Before operating your ultrasonic generator, read this User's Manual to become familiar with the equipment. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this generator. The examples given are chosen for their simplicity to illustrate basic operation concepts.

### Notes, Cautions and Warnings

Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They have important information that, if ignored, could have increasingly severe outcomes. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a operator protection issue.

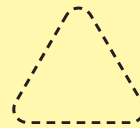
### Drawings and Tables

The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use Arabic sequence numbers (e.g. 1, 2, 3) while the tables use roman sequence numerals (e.g. I, II, III). As an example, Figure 3-2 would be the second illustration in Section 3 while Table 3-II would be the second table in Section 3.

#### NOTE

Note statements provide additional information or highlight procedures.

#### CAUTION



Caution statements identify conditions or practices that could result in damage to the equipment or other property.

#### WARNING



Warning statements point out conditions or practices that could result in personal injury or loss of life.



Condition  
or Practice



Electrical  
Hazard



Hearing  
Protection

## Generator Overview

This generator is designed for basic ultrasonic applications that use either manually operated hand probes or ultrasonic probes controlled by automation systems. Using the available system control inputs and output status signals, it can easily be controlled by automated machines.

The generator design accepts several control input signals, and provides system status output signals.

This product has rugged internal ultrasonic generator circuitry and ensures a continuous resonant frequency lock at the start of each weld. The LCD display can be used to change the factory default ultrasonic settings for the drive signal phase delay angle, starting frequency and ramp-up or ramp-down parameters. This enables users to modify the generator performance to meet a wide variety of ultrasonic processing requirements.

The generator's compact size allows multiple units to be placed into an industrial equipment cabinet. This generator will operate at the same international line voltage input specifications as the other generators of this product family (unless the 120V option is installed). It also includes an RFI line filter that passes FCC, CE, UL, and CSA testing for global applications.

## Key Generator Features

- **Compact Enclosure Size** means that a very small footprint is required for the horizontal benchtop configuration. It is also available in a vertical back-plate mount configuration for incorporation into automated machine cabinets. **220/240VAC systems** - Rated at 1200 watts or less, come in a low profile (3.5") compact enclosure, while systems rated above 1200 watts come in a high profile (5.25") standard enclosure size. **110/120VAC systems** - Rated up to 1200 watts, come in the high profile (5.25") enclosure.
- **Pulse Width Modulation** incorporates circuitry giving the generator the ability to efficiently change the output amplitude. This makes it possible to start large horns with reduced power. It also provides more power efficient switch-mode generator operation and increased reliability.
- **Linear Ramp Up/Down** circuitry allows the acoustic stack to be brought to operating amplitude smoothly,

minimizing start-up surges and undue stress to stack and generator. This circuitry also allows decreases to amplitude as the weld cycle ends. The stack is brought down from its maximum operating amplitude smoothly, reducing shock stress.

- **Digi-Trac Tuning** tracks the resonant frequency of the acoustic stack (horn, booster, and transducer) and adjusts the generator output frequency to match it. This is done for every weld cycle and eliminates the need to manually tune the generator.
- **Line Voltage Regulation** automatically maintains constant amplitude regardless of line voltage deviation. The available output power is maintained with any voltage input within the specified range. This provides consistent system performance regardless of line voltage fluctuations. It also eliminates the need for bulky, external constant-voltage transformers.
- **Load Regulation** provides constant ultrasound amplitude automatically regardless of power draw. The ultrasonic output amplitude level is held to within  $\pm 1\%$  to provide weld process consistency and reduced weld cycle times.
- **Wide Line Voltage Operation** means that standard systems will operate worldwide within their standard AC voltage ranges.
- **Flow Through Cooling Tunnel** with a high-performance heatsink and thermostatically controlled fan reduces thermal gradients and increases component life.
- **AC Power Inrush** protection reduces electrical stress on the internal components by protecting them from AC power start-up transient current surges.
- **Multiple Electronic Overload** protection circuits prevent instantaneous component failure in the event of extreme output overload conditions.
- **CE Certification** means that the system meets the required European standards to be sold and used in Europe.
- **ISO 9001 Certification** means that this system has been manufactured to high quality standards and assures you of manufacturing excellence.

# SECTION 2

## Health and Safety

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## General Considerations

Please observe these **health and safety recommendations** for safe, efficient, and injury-free operation of your equipment.

**Proper Installation** - Operate system components only after they are properly installed.

**No Unauthorized Modifications** - Do not modify your system in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications could cause equipment damage and/or injury to the operator. In addition, unauthorized modifications will void equipment warranty.

**Keep the Cover On** - Do not remove any equipment cover unless directed to do so by Dukane Corporation. The generator produces hazardous electrical voltages which could cause injury.

**Grounded Electrical Power** - Operate this equipment only with a grounded electrical connection.

See *Electrical Safety* for grounding instructions, Page 9.

**Comply with Regulations** - You may be required to add accessories to bring the system into compliance with applicable regulations (OSHA in the USA) for machine guarding and noise exposure.

**Use Eye Protection** - Wear ANSI approved safety impact goggles.

**Acoustic Stack Hazard** - When an acoustic stack (transducer, booster, horn and tip) is energized by the ultrasound signal, it presents a potential hazard. Stay clear of an energized stack.

**System E-STOP (abort) Switch** - Install a system E-STOP (abort) switch at each operator station when ultrasonic plastic assembly equipment is used with automatic material handling equipment in an automated system.

**Foot Switch** - Using a foot switch in place of the optical touch finger switches (operate switches) violates OSHA regulations.

### NOTE

These recommendations apply to the welding system. System in this manual refers to a complete group of components associated with the welding of parts, also known as an ultrasonic assembly system. A typical *iQ Series* System consists of the *iQ* generator, a press with thruster, switches, controls, cables, transducer, booster, horn, fixture, and *iQ Explorer II* software.

### WARNING



Any fixture manufactured by a third party must comply with all OSHA and ANSI requirements. All fixtures must be guarded as necessary.

Dukane Corporation does not assume any responsibility or liability for fixtures manufactured by the customer or any third party manufacturer.

### WARNING



Never operate the generator with the cover off. This is an unsafe practice and may cause injury.

### CAUTION



At some time you may be asked to remove equipment covers by the Dukane Service Dept. personnel. Before doing so, disconnect the unit electrically from the incoming line AC power. If the unit is a press/thruster, lock the Air Lockout Valve, located on the rear panel, in its closed position.

*Continued*

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## General Considerations

**Pre-trigger Switch Adjustment** - The pre-trigger switch option starts the horn vibrating before contacting the part to be welded. To ensure safe operation, adjust the pre-trigger so the ultrasound signal will not activate if the horn is more than  $\frac{1}{4}$  in (7 mm) from the part to be welded.

**System Electrical Cabling** - Electrical power must be off when connecting or disconnecting electrical cables.

**Do Not Wear Loose Clothing or Jewelry** - They can become caught in moving parts.

**Stay Alert** - Watch what you are doing at all times. Use common sense. Do not operate the press when you are tired or distracted from the job at hand.

**Do not Operate the Equipment** - Your judgement or reflexes could be impaired while taking prescription medications. If so, do not operate the equipment. Be familiar with warning labels and recommended activity restrictions that accompany your prescription medications. If you have any doubt, do not operate the equipment.

## Plastics Health Notice

Certain plastic materials, when being processed, may emit fumes and/or gases that may be hazardous to the operator's health. Proper ventilation of the work station should be provided where such materials are processed. Inquiries should be made to the U.S. Department of Labor concerning OSHA regulations for a particular plastic prior to processing with Dukane ultrasonic equipment.

## Electrical Safety

The *iQ Series* generator provides the operating power and power returns. Make sure the generator is grounded properly.

In addition to the safety considerations, proper grounding is essential for the effective suppression of RFI (Radio Frequency Interference). Every generator contains a RFI filter which blocks noise on the AC power line from entering the generator control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line.

If you experience problems with RFI from the press, run an additional grounding wire from the press base grounding stud to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. Use at least 14 AWG wire for the connection to the press base.



### CAUTION

Parts being joined ultrasonically will at times vibrate at audible frequencies. Wear ear protectors to reduce annoying or uncomfortable sounds. In addition, ultrasound baffles, sound enclosures, or materials that absorb sound may be located to surround the system.



### WARNING

**Keep head, hands, limbs and body at least six inches (152 mm) away from an operating press/thruster.**  
**A vibrating, descending horn can cause burns and/or crushing injuries.**



### CAUTION

When making cable connections to system equipment or disconnecting cables from system equipment, make sure electrical power to the system is turned off, and AC power cords are removed from their receptacles. After the cables have been securely connected and the connections and cable routing checked a final time, the power may be restored.

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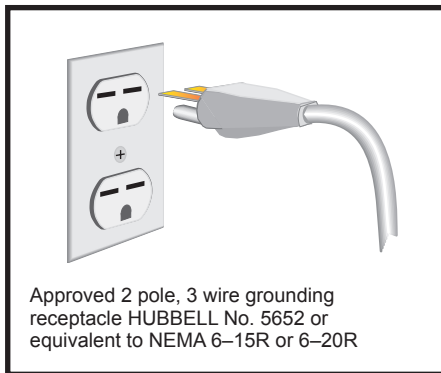


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## Electrical Safety

### Domestic Power Grounding

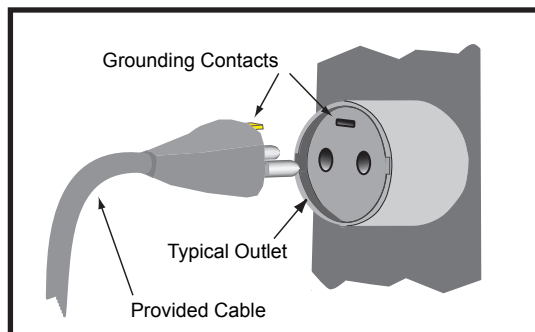
For safety, the power cords used on this product have a three-wire, grounding-type power cord. Figure 2-1 illustrates the appropriate electrical outlet to use with the power cord that is included with systems shipped to North America.



**Figure 2-1** Example of 220/240 Volt, Grounded, 3-Prong Receptacle

### International Power Grounding

The power cable normally provided for international use is compatible with the power outlet used in many Continental European countries (Refer to Figure 2-2.) However, if your application requires another type of power cord, check with your equipment supplier, and follow local regulations concerning proper wiring and grounding.



**Figure 2-2** International 220/240V Grounding

#### CAUTION



If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply. See Figures 2-1 and 2-2.

#### CAUTION



If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

#### 100/120 Volt AC Systems

(North America or Japan)

The power cord (including strain relief) supplied with the 100/120VAC systems is permanently attached to the rear of the generator. Units with this power cord are for use in North America or Japan.

#### NOTE

See *Section 10, Options* if your system has a non-detachable power cord for 120VAC operation.

## Lifting the Equipment

### How to Lift Safely

- Before lifting, take a moment to think about what you're about to do.
- Examine the object for sharp corners, slippery spots or other potential hazards. Know your limit and don't try to exceed it.
- Ask for help if needed, or if possible, divide the load to make it lighter.
- Know where you are going to set the item down, and make sure it and your path are free of obstructions. Then follow these steps:
  1. Stand close to the load with your feet spread apart about shoulder width, with one foot slightly in front of the other for balance.
  2. Squat down bending at the knees (not your waist). Tuck your chin while keeping your back as vertical as possible.
  3. Get a firm grasp of the object before beginning the lift. Begin slowly lifting with your LEGS by straightening them. Never twist your body during this step.
  4. Once the lift is complete, keep the object as close to the body as possible. As the load's center of gravity moves away from the body, there is a dramatic increase in stress to the lumbar region of the back.
  5. If you must turn while carrying the load, turn using your feet-not your torso. To place the object below the level of your waist, follow the same procedures in reverse order. Remember, keep your back as vertical as possible and bend at the knees.

#### NOTE

For equipment weights see **Section 11, Specifications**, Page 89.



#### CAUTION

Take care when lifting the equipment. We recommend using a mechanical lift device to assist.

# SECTION 3

## Installation

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## Before Installation

As you plan for the installation of your generator, please consider these important subjects as listed below:

- When to use lockout / tagout devices
- Lifting the generator safely - See *Section 2 - Health and Safety*, Page 10.

## When to Use Lockout / Tagout Devices



**Figure 3-1** Lockout Device In Open Position, Unlocked

The typical kind of LOTO device for this generator is a clam shell type device (with lockout capability). The LOTO device is placed over the plug end of the generator electrical cord. This effectively prevents access to the energy isolation point. See the example of one such device in the figure above.

The figure to the right shows the lockout device in the closed, locked position.



**Figure 3-2** Bottom Lockout Device In Closed Position, Locked



### WARNING

Electrical safety hazards exist inside the generator chassis. Before making any internal adjustments to the generator, apply a lockout/tagout (LOTO) device to the generator chassis.

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## Lockout/Tagout

### **Procedure to use BEFORE making any internal adjustments to the generator:**

1. Push the generator's AC power switch/breaker to the OFF position.
  2. Unplug the generator's electrical cord from its source.
  3. Authorized personnel apply a lockout/tagout (LOTO) device to the plug end of the generator's electrical cord. Using a typical clam shell type LOTO device:
    - 1) Open the clam shell.
    - 2) Place the electrical cord plug end inside the shell.
    - 3) Close the shell.
    - 4) Secure the shell with its lock, and lock it.
  4. Wait a minimum of five minutes for the generator to discharge its electrical energy.
  5. After taking these steps, make the necessary adjustments to the generator.
- 

Assuming the generator is being put back into service.

### **Procedure to use AFTER making any internal adjustments to the generator:**

1. Authorized personnel remove the lockout/tagout device from the plug end of the generator's electrical cord. Using a typical clam shell type LOTO device:
  - 1) Unlock the protective shell.
  - 2) Open the shell, exposing the electrical cord end.
  - 3) Remove the LOTO device, and set it aside.
2. Plug the generator's electrical cord into its AC power source.
3. Push the generator's AC power switch/breaker to the ON position.

## Unpacking

Carefully open your shipping container, and make sure it contains the items shown on the shipping documents. Inspect all items, and report any damage immediately.

## Placing

### Vertical Panel Mount Chassis

Make certain the generator placement and cable routing allow for easy access and that they do not interfere with normal operation. The operator should have unobstructed access to any control switches and should have a clear view of the LCD panel, and generator status LEDs.

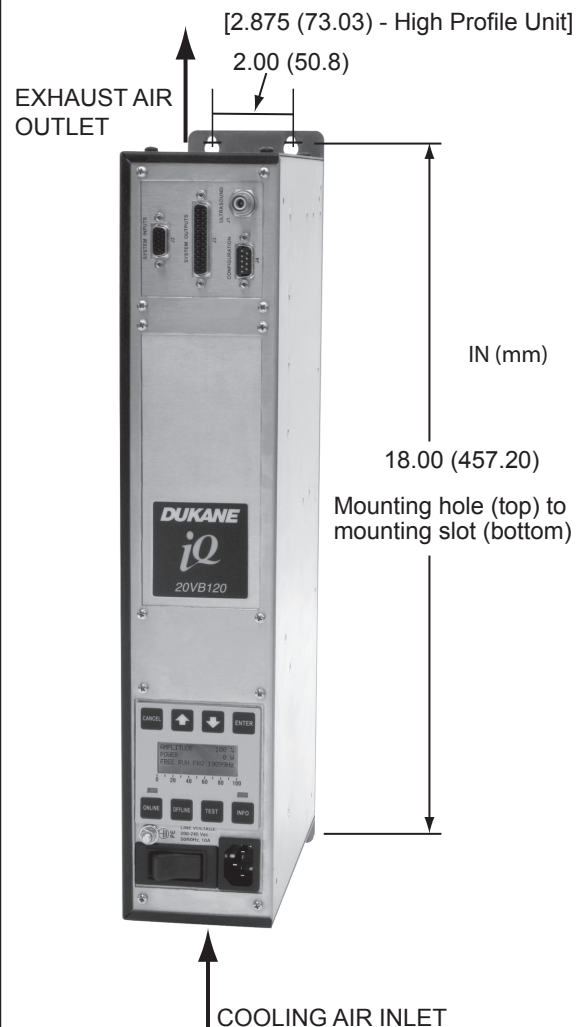
Attach the generator securely to the upper and lower rails of the mounting panel with its control panel easily accessible as shown in Figure 3-3. Allow at least 5 inches (13 cm) of space on the top and bottom of the generator chassis for air circulation. If the generator is installed inside an enclosure with a front door, be sure to allow at least 3 inches (8 cm) clearance behind the door for the system cables.



### CAUTION

Allow 5 inches for air ventilation at the cooling air inlet and at the exhaust air outlet. The fan draws in fresh air to cool the internal components, reduce thermal gradients and increase component life.

If excessive dust accumulates in the slots, wipe or vacuum them clean. Do not use compressed air as this may force the dust inside the chassis.

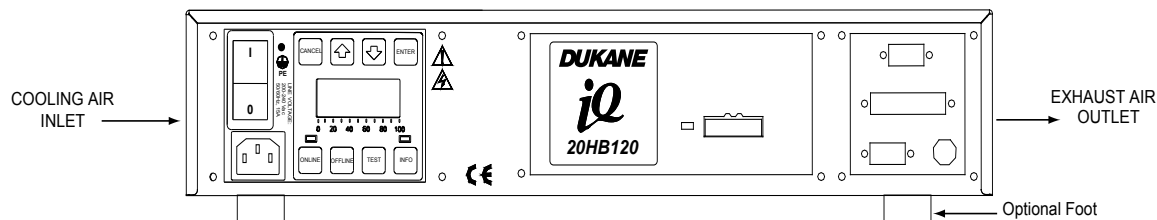


**Figure 3-3** Vertical Panel Mount Chassis Placement  
(Low profile unit shown with optional panel mounting plate.)

## Horizontal Bench Chassis

Generator placement and cable routing should permit easy access and not interfere with normal system operation.

Allow at least 5 inches (13 cm) of space on both ends of the generator chassis for air circulation. Allow a 3 inch space (8 cm) in the front of the chassis for cable clearance.

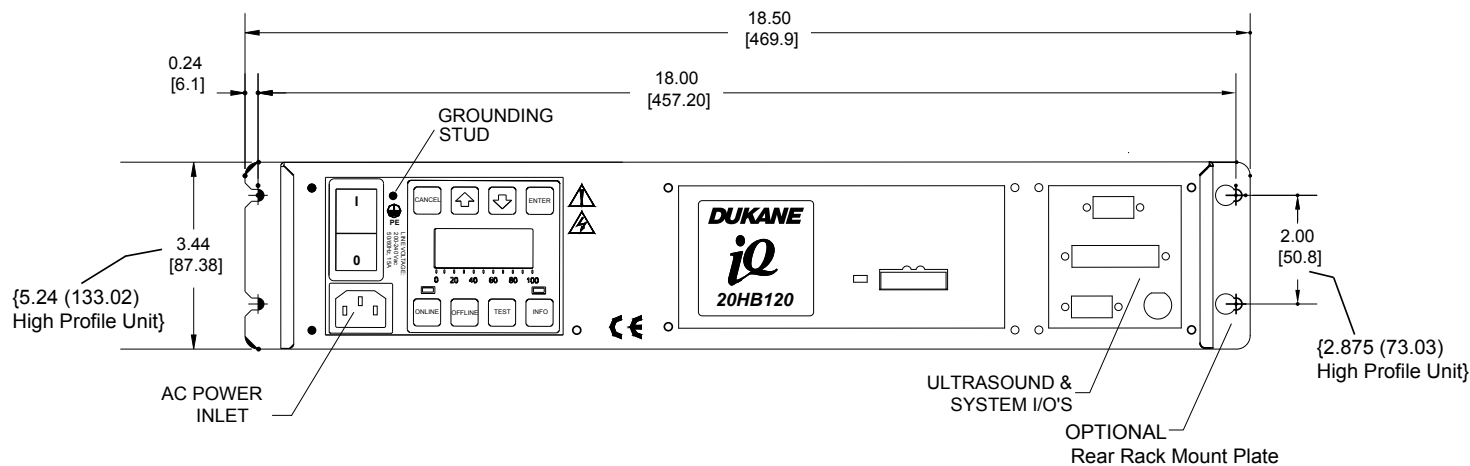


**Figure 3-4** Horizontal Bench Chassis (shown with optional feet)

## Horizontal Panel Mount Chassis

Generator placement and cable routing should permit easy access and not interfere with normal system operation.

Allow at least 5 inches (13 cm) of space on both ends of the generator chassis for air circulation. Allow a 3 inch space (8 cm) in the front of the chassis for cable clearance.



**Figure 3-5** Horizontal Panel Mount Chassis (low profile unit shown with optional rear rack mount plate)



## RFI Grounding

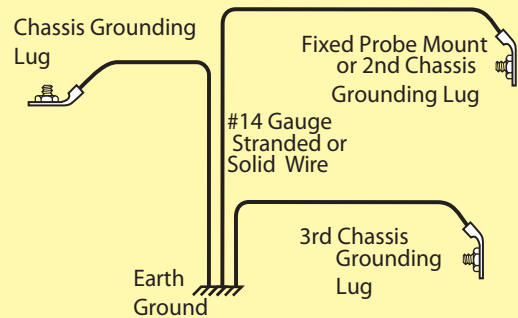
In addition to the safety considerations previously mentioned, proper grounding at the generator power cord is essential for the effective suppression of electrical noise or RFI (Radio Frequency Interference). Every ultrasonic generator contains a RFI filter which blocks noise on the AC power line from entering the system control circuitry. This filter also prevents ultrasonic frequency noise from being fed back into the AC power line. In order for the RFI filter to operate properly, it is necessary to correctly ground the system. Run a grounding wire from the ground stud connection (see Figure 3-5) to the nearest grounded metal pipe or equivalent earth ground, and secure it with a ground clamp.

If you have multiple ultrasonic generators, run a separate ground wire from each unit to earth ground. Use at least a 14 AWG wire for the connection to the system chassis. Stranded wire is more flexible and easier to work with than solid wire. However if you use stranded wire, a crimped lug on both ends will help ensure a good electrical connection. Green or Green with a Yellow stripe is the recommended wire color for a protective earth ground connection.



### CAUTION

To minimize electrical noise and eliminate ground currents, ground the chassis as shown. Use a STAR configuration (illustrated below). Do not DAISYCHAIN the grounds.



### CAUTION

Before connecting or disconnecting cables: Put power switches for the *iQ* generator, and any user-supplied equipment in the OFF position. Turn off electrical power. Remove AC power cords from their receptacles.



### CAUTION

**DO NOT** operate the generator unless the ultrasound coaxial cable is connected and the acoustic stack/probe has been properly installed. Otherwise, an overload condition could occur, with possible damage to the generator.


## Connecting Cables (Quick Start Guide)

The connections are the same for both the vertical and horizontal generator configurations. However, the panel location of the connectors differs between the two chassis styles. Details about the various system connectors and their pin assignments are covered in Section 4.

### Manually Operated Probe System (Hand Probes)

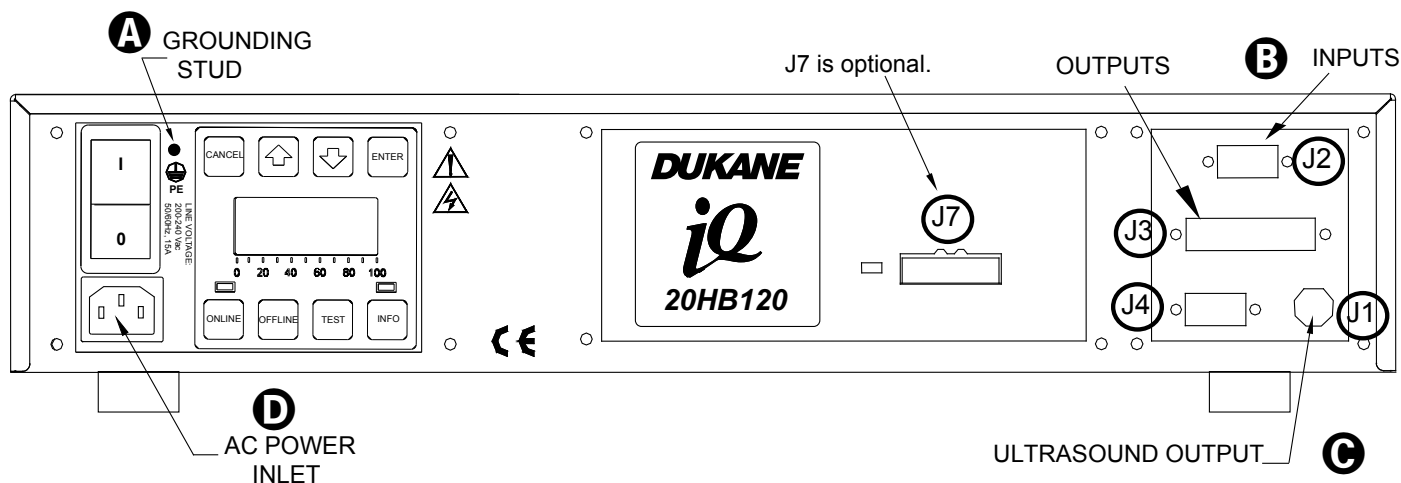
1. Ground the generator chassis with a user-supplied 14-Gauge wire and attach it to the grounding stud A in Figure 3-6.
2. Attach the hand probe's HD-15 system input connector to J2 on the I/O panel. **B** in Figure 3-6.
3. Attach high-voltage coaxial cable to J1, the ultrasound output connector. **C** in Figure 3-6.
4. Power cords with an IEC connector are supplied with the standard horizontal bench and vertical panel mounted systems. Connect the AC power cord to the IEC power inlet connector on the ultrasonic generator (**D** in Figure 3-6), and plug the other end into an approved AC outlet.

**CAUTION**



The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it is replaced with a properly grounded three-lead receptacle.

Have a qualified electrician do the replacement in accordance with the National Electrical Code and local codes and ordinances. **DO NOT** cut off the power cord grounding prong or alter the plug in any way.



**Figure 3-6** Horizontal Bench Generator with Hand Probe Cable Connections

**NOTE**

Horizontal bench generator is shown for reference. Vertically mounted units use the same connections, but those connections have a different orientation. (See Figure 4-1.)

## Power Cords

The 3-wire grounding AC line cords supplied with the standard generators are matched to the ultrasonic output power rating and the continent of specified use.

See Table 3-I.

Part Number	Continent of Use
200-1110	North America, 240V 15A
200-1541	North America, 240V 10 A
200-1111	Continental Europe, 240V 16A
200-1542	Continental Europe, 240V 10A

**Table 3-I** Standard IEC AC Power Cord Part Numbers

## Automation Controlled Probe System

(See Figure 3-4 for connection locations.)

1. Ground the generator chassis using the supplied 14 - Gauge wire - attaching it to the grounding stud.  
**A** in Figure 3-6.
2. *Optional – Ground the probe support. This is a user-supplied 14-Gauge wire.*
3. Attach the automation control cable from the user-supplied automation equipment to the system input HD-15 connector, J2 on the I/O panel. **B** in Figure 3-6.
4. Attach the high voltage coax cable from the probe to the ultrasound output connector J1.  
**C** in Figure 3-6.
5. Power cords with an IEC connector are always supplied with bench chassis style generators and standard vertical panel mounted units. Connect the AC power cord to the generator IEC power inlet connector, and plug the other end into an approved AC outlet. **D** in Figure 3-6.

### NOTE

Refer to *Section 10, Options*, for information about 120VAC line operation and other features.



### WARNING

Any modifications to the Activation Switch (also known as the Operate Switch) circuit must comply with all OSHA and ANSI requirements. Compliance with all local building and electrical codes is also required.

Dukane Corporation does not assume any responsibility or liability for circuitry modifications made by the customer or by any third party manufacturer.



### WARNING

Any modifications to the Emergency Stop Switch (also known as the E-STOP or Abort Switch) circuit must comply with all OSHA and ANSI requirements. Compliance with all local building and electrical codes is also required.

Dukane Corporation does not assume any responsibility or liability for circuitry modifications made by the customer or by any third party manufacturer.

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# SECTION 4

## Standard Connections

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## Panel Layout Overview

### Vertical Panel Mount Chassis

This section provides an overview of the vertical panel mount chassis panel layout, which includes panel areas dedicated to various standard system functions and options. Figure 4-1 illustrates the panel layout for a vertical panel mount chassis.

#### AC Power Inlet Panel

- A** IEC Power Inlet Connector – Attaches to an IEC style power cord.
- B** Power Switch / Circuit Breaker – Used to switch system power ON and OFF.
- C** Chassis Ground Stud – Chassis connection for a protective earth ground.

#### System Status Control Panel and Display

- D** INFO Key.
- E** System Operating Mode Keys and Status LEDs.
- F** Power Output Level Scale.
- G** 4-line LCD Display.
- H** Display Control Keys.

*Section 5 provides descriptions of these basic user controls and status LEDs.*

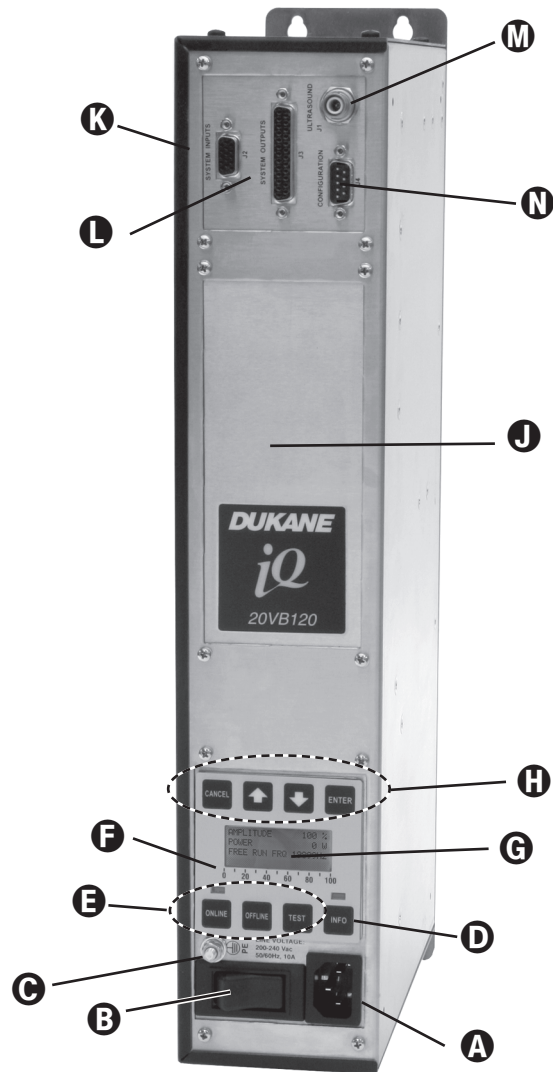
#### Option Module Panel

(A blank panel is installed on standard systems.)

- J** An Option Module can be installed here.

#### System I/O Panel

- K** System Input Connector J2 – Connections for system control input signals
- L** System Output Connector J3 – Connections for system status output signals
- M** Ultrasound Output Connector J1 – Coaxial high voltage connection to ultrasonic stack
- N** Configuration Port Connector J4 – Digital control port to modify system parameters



**Figure 4-1** Panel Layout - Vertical Panel Mount Generator

#### NOTE

Refer to *Section 10, Options*, for more information about *iQLinQ™*.

## Horizontal Bench Chassis

This section provides an overview of the horizontal bench generator panel layout, which includes panel areas dedicated to various standard system functions and options that are available. Figure 4-2 illustrates the panel layout.

### AC Power Inlet Panel

- A** IEC Power Inlet Connector – Attaches to an IEC style power cord
- B** Power Switch / Circuit Breaker – Used to switch system power ON and OFF
- C** Chassis Ground Stud – Chassis connection for a protective earth ground

### System Status Control Panel and Display

- D** INFO Key.
- E** System Operating Mode Keys and Status LEDs.
- F** Power Output Level Scale.
- G** 4-line LCD Display.
- H** Display Control Keys.

*Section 5 provides descriptions of these basic user controls and status LEDs.*

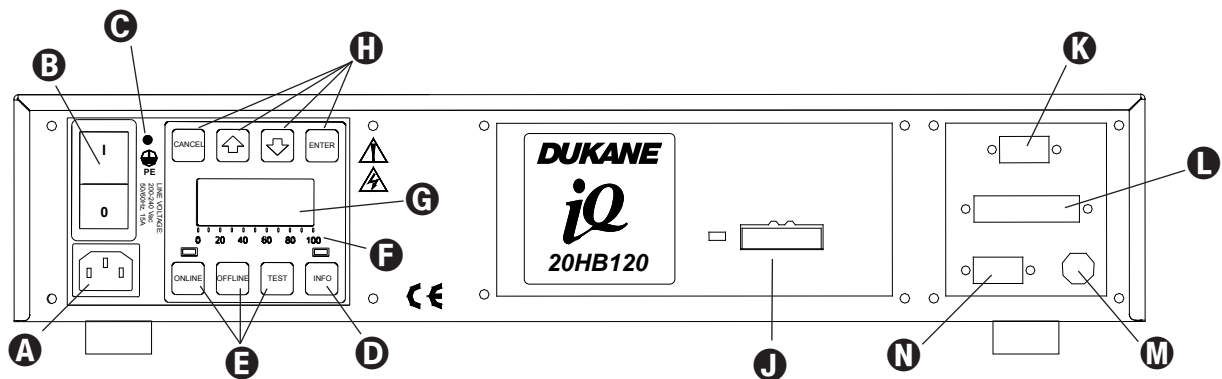
### Option Module Panel

(A blank panel is installed on standard systems.)

- J** An option module can be installed here.

### System I/O Panel

- K** System Input Connector J2 – Connections for system control input signals.
- L** System Output Connector J3 – Connections for system status output signals.
- M** Ultrasound Output Connector J1 – Coaxial high voltage connection to ultrasonic stack.
- N** Configuration Port Connector J4 – Digital control port to modify system parameters.



**Figure 4-2** Panel Layout - Horizontal Bench Generator



## AC Power Inlet Panel

The standard AC power inlet panel is described in this section.

### IEC AC Power Inlet Connector

The IEC AC power inlet connector mounted on the system AC power inlet panel requires a properly configured IEC compliant power cord, which enables worldwide system operation by simply changing the power cord.

Low profile systems are equipped with a 10 Amp rated IEC inlet connector. The high profile systems include a 16/20 ampere rated IEC inlet connector.

An appropriately rated power cord must be securely attached to the welding system's IEC inlet connector. If the correct power cord configuration is not included with the system for the local AC power outlet at your location, an appropriate IEC power cord should be available from a local electrical parts supplier. Note that the system under-voltage lockout will inhibit system operation if a North American power cord configured for 120V is connected to the system. A minimum of 200V is required for the system to operate.

### Power Switch/Circuit Breaker

The power switch/circuit breaker has a rocker type actuator switch that will activate or deactivate the AC power to the system. The power ON position is marked with the internationally recognized **I** symbol, the power OFF position is marked with the **0** symbol. This power switch also integrates an appropriately sized over-current protection circuit breaker function in the generator.

If an over-current condition trips the circuit breaker, it will automatically switch to the OFF position. If the overload current that caused the circuit breaker to trip is due to a transient condition, the circuit breaker can be reset by switching the actuator back to the ON position. If when resetting the circuit breaker after it has tripped, it immediately trips again, there is likely an internal system malfunction, and the generator will require service.

Do not repeatedly try to reset the circuit breaker. If it trips, this will only cause more damage to the generator.

### Chassis Ground Stud

The chassis ground stud is used to attach a protective earth ground to the generator. This will aid in the suppression of electrical interference or radio frequency interference (RFI) that is common in a industrial environment. The chassis ground stud is **Ⓒ** in Figure 4-2. Proper system grounding is discussed in Section 3.

#### NOTE

Refer to *Section 10, Options*, for information on optional 120VAC line operation.

## System I/O Panel

The standard system I/O panel is described in this section.

### System Inputs Connector

The SYSTEM INPUTS connector mounted on the system I/O panel includes connections for all of the basic system control input signals, that will typically come from an automated control system. The cable attached to this connector includes all of the available system control signals, which will be controlled by an output card or output port on the automation controller.

The user can determine which signals to use for each particular welding application, but there must be at least one connection to this connector in order to activate the ultrasound output. All of the input signals on this connector are electrically isolated (signals are NOT referenced to chassis ground) and activated when a 24VDC voltage source is connected to the signal input pin, referenced to the isolated common pin. The electrically isolated input signals can be driven from an automations controller output that is either sinking (NPN) or sourcing (PNP), depending upon how the isolated common connection is terminated. All inputs sink or source 10mA of current from a 24VDC power supply.

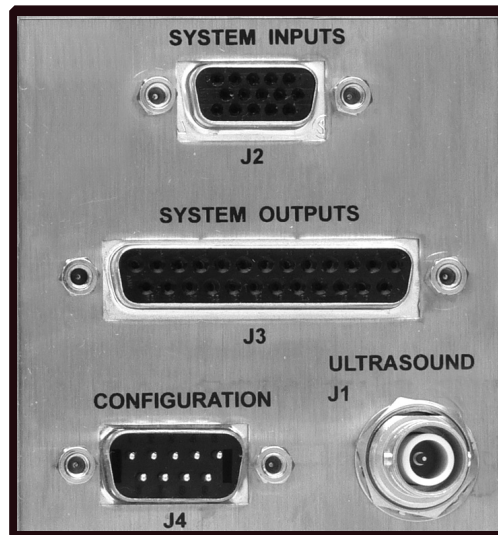
Note that a simple switch closure (relay contact) connected to a control input can not activate the input without adding an external power supply to power the input. Adding jumper connections to pins available on the System Inputs connector, can configure switch closure inputs to operate referenced to generator chassis ground (non-isolated), without adding a separate power supply, if desired. Refer to Application Note AN502 at:

<http://www.dukane.com/us/downloads.asp?type=Application%20Notes>

for detailed wiring diagrams of example applications.

### System Inputs Connector Pinout

The SYSTEM INPUTS connector is a HD-15F (high density D-subminiature 15 circuit female) connector. Connector pin assignments are shown in Figure 4-4. The male connector on the cable is a mirror image of the panel mounted connector and is shown in Figure 4-5. Table 4-I lists the signal names and descriptions, with more detailed descriptions listed below. The wire color coding for the system input cable is listed in Table 4 -I, to assist with custom automation system wiring and assembly.



**Figure 4-3** System I/O Panel (standard panel shown)

Pin	Signal Name	Cable Color Code	Signal Option Requirements
1	+22V	BLK	
2	Power Ground	WHT	
3	Remote Setup Selection Bit 0 Input	RED	MPC Option Required
4	Remote Setup Selection Bit 1 Input	GRN	MPC Option Required
5	Remote Setup Selection Bit 2 Input	ORN	MPC Option Required
6	Remote Setup Selection Bit 3 Input	BLU	MPC Option Required
7	Remote Setup Selection Bit 4 Input	WHT/BLK	Not Used
8	Ultrasound Activation/Cycle Start Input	RED/BLK	
9	Automation Thruster Control Input	GRN/BLK	Automation Thruster Board Required
10	Front Panel Lockout	ORN/BLK	
11	Press Inhibit for Hand Probes	BLU/BLK	Hand Probe
12	System Latch Reset Input	BLK/WHT	
13	Isolated Common	RED/WHT	
14	Not Used	GRN/WHT	
15	Automation Cycle Stop Input	BLU/WHT	

**Table 4 - I** Generator Input Signals

## System Inputs Signal Descriptions

### Pin 1 (+22V)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

### Pin 2 (Power Gnd)

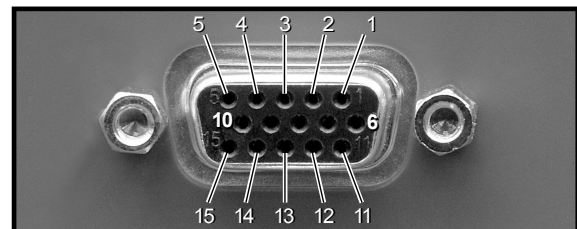
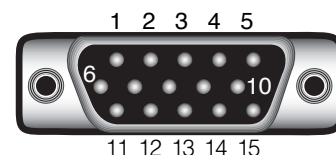
Pin 2 is the 22VDC return and is tied to the system chassis ground.

### Pin 3 (Remote Setup Selection Bit 0 Input)

Pin 3 is the Remote Setup Selection Bit 0, which is the least significant bit used to select different welding setups with an automation control system (if the welder includes a process controller) and this input is also used to select different channels when a Multiple Probe Controller (MPC) Interface option board is installed.

### Pin 4 (Remote Setup Selection Bit 1 Input)

Pin 4 is the Remote Setup Selection Bit 1, which is the second least significant bit used to select different welding setups with an automation control system (if the welder includes a process controller) and this input is also used to select different channels when a Multiple Probe Controller (MPC) Interface option board is installed.

**Figure 4-4** HD-15F for Generator Input Connector**Figure 4-5** HD-15M for Generator Input Cable Connector

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#### **Pin 5 (Remote Setup Selection Bit 2 Input)**

Pin 5 is the Remote Setup Selection Bit 2, which is the third least significant bit used to select different welding setups with an automation control system (if the welder includes a process controller) and this input is also used to select different channels when a Multiple Probe Controller (MPC) Interface option board is installed.

#### **Pin 6 (Remote Setup Selection Bit 3 Input)**

Pin 6 is the Remote Setup Selection Bit 3, which is the second most significant bit used to select different welding setups with an automation control system (if the welder includes a process controller) and this input is also used to select different channels when a Multiple Probe Controller (MPC) Interface option board is installed.

#### **Pin 7 (Remote Setup Selection Bit 4 Input) (Not used on the basic model generator)**

Pin 7 is the Remote Setup Selection Bit 4, which is the most significant bit used to select different welding setups and can only be used with an advanced control system. This bit will not be used when a Multiple Probe Controller (MPC) Interface option board is installed.

#### **Pin 8 (Ultrasound Activation/ Cycle Start Input)**

Pin 8 is used to activate the generator ultrasound output. Activation of this control input will switch the ultrasound output ON, and deactivating this signal will switch ultrasound OFF. On systems equipped with a welding process controller, this input signal will function as a cycle start input, where the ultrasound activation and timing are completely under the control of the process controller. Depending on the welding process controller setup, this input signal could be activated momentarily to start a welding cycle.

#### **Pin 9 (Automation Thruster Control Input)**

Pin 9 is used only when an optional automation thruster control board is installed. Activation of this input would cause the thruster attached to the option board to go to the down position. When this signal deactivates, the thruster will move to the up position. This option is typically used for a continuous welding process, when the user wants to retract the ultrasonic stack away from the process (or material) when the ultrasound is off or some changes in the process are being made. This input control signal will

be ignored and not functional if the thruster control board is configured for “ultrasound slave mode”, which will activate the thruster to the down position when the generator ultrasound output is activated.

#### **Pin 10 (Front Panel Lockout Input)**

Pin 10 is used to lock the front panel user interface, so a user cannot change any welding setups or configuration parameters that are stored in memory. The user can use the interface controls to view welding information, but no setup changes are allowed. Deactivation of this signal allows normal operation, without any lockout restrictions.

#### **Pin 11 (Press Inhibit for Hand Probes)**

Pin 11 is used to disconnect power applied to a press or thruster, if a hand probe is connected to the system input connector, for safety considerations. The hand probe activation switch could unexpectedly start a welding cycle that activates a press or thruster to the down position. The hand probe cable connector is wired to apply chassis ground to this pin, when it is attached to the system, which activates a press inhibit relay that disconnects power from the pneumatic press valves. This pin must be left open whenever a press control board is installed. Connecting this pin to chassis ground will inhibit press operation.

#### **Pin 12 (System Latch Reset Input)**

Pin 12 is used to reset the Any Fault or System Overload status outputs (See Status Output descriptions.). If a fault occurs during a weld cycle, these outputs will normally remain active until the next weld cycle is initiated. Activating this input will reset the status output faults and may simplify automation programming.

#### **Pin 13 (Isolated Common)**

Pin 13 is electrically isolated from chassis ground and is the default input configuration. Using isolated sourcing (PNP) output drivers, this common line would be connected to isolated ground potential. Using isolated sinking (NPN) output drivers, this common line would be connected to the isolated positive supply voltage output.

#### **Pin 14 (Not Used)**

Pin 14 is an open connection.

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*Continued from Previous Page***Pin 15 (Automation Cycle Stop Input)**

Pin 15 is an input control signal that when configured to the factory default setting, stops ultrasound when this input is activated. It can be used by the automation control system as a redundant signal to shut the ultrasound output off.

**System Outputs Connector**

The SYSTEM OUTPUTS connector mounted on the generator I/O panel includes connections for all of the basic system status and monitor output signals, which will typically connect to an automated control system. The cable attached to this connector includes all of the available system output signals, which will be read or monitored by a digital input card or analog inputs on the user supplied automation controller.

The user can determine which signals are appropriate for each welding application. If operational system status is not important, connections to this connector are not required for system operation.

The system monitor output signals are analog signals used to monitor ultrasonic amplitude setting, and ultrasonic output power levels, referenced to the Monitor Common (Pin 13). This is at system chassis ground potential (non-isolated). All of the digital output status signals on this connector, are isolated (signals are not referenced to generator chassis ground). When a status output signal is activated, it will sink current (500mA sourced by a 30VDC supply are the maximum output ratings) to isolated common. In automation terms, the outputs are NPN (sinking) and would drive a PNP (sourcing) input that is referenced to the Isolated Common pin.

The digital status output signals can only sink current to isolated common. They cannot be changed to a sourcing (PNP) type output. If sourcing status outputs are required, there is an optional isolated NPN to PNP conversion module that is DIN rail mounted. The module converts the standard isolated sinking (NPN) status output signals to isolated sourcing (PNP) status output signals.

**System Outputs Connector Pinout**

The SYSTEM OUTPUTS connector is a DB-25F (standard D-subminiature 25 circuit female) connector. Connector pin assignments are shown in Figure 4-6. The male connector on the cable is a mirror image of the panel mounted connector and is shown in Figure 4-7. Table 4-II lists the signal names and descriptions. More detailed descriptions are listed in the System Outputs Signal Descriptions section below. To assist with custom automation system wiring and assembly, the wire color coding for the system outputs cable is listed in Table 4-II.



Pin	Signal Name	Cable Color Code	Signal Option Requirements
1	+22V	BLK	
2	Not Used	WHT	
3	+22V Power Ground	RED	
4	Programmable Status Output 1	GRN	Not Available
5	Programmable Status Output 2	ORN	Not Available
6	Ultrasound Active Status Output	BLU	
7	Any Fault Status Output	WHT/BLK	
8	Press Trigger Status Output	RED/BLK	Not Available
9	System Overload Status Output	GRN/BLK	
10	System Online Status Output	ORN/BLK	
11	Press Top of Stroke Status Output	BLU/BLK	Not Available
12	Current Loop OK Status Output	BLK/WHT	Remote Control Option Board
13	Analog Monitor Signal Common	RED/WHT	
14	Not Used	GRN/WHT	
15	Power Signal Monitor Output	BLU/WHT	
16	Amplitude Monitor Output	BLK/RED	
17	Amplitude/Power Regulation Status Output	WHT/RED	
18	MPC Ready Status Outputs	ORN/RED	MPC Option Board
19	System Power OK Status Output	BLU/RED	
20	Bad Part Status Output	RED/GRN	Not Available
21	Good Part Status Output	ORN/GRN	Not Available
22	System Ready Status Output	BLK/WHT/RED	
23	Suspect Part Status Output	WHT/BLK/RED	Not Available
24	Isolated Common	RED/BLK/WHT	
25	Not Used	GRN/BLK/WHT	

**Table 4 - II** System Output Connector Signals

## System Outputs Signal Descriptions

### Pin 1 (+22V Power Supply)

This pin can supply +22VDC at up to 250mA to power the user's automation controls.

### Pin 2 (Not Used)

Pin 2 is an open connection.

### Pin 3 (+22V Power Ground)

Pin 3 is the 22VDC return and is tied to the system chassis ground.

### Pin 4 (Programmable Status Output 1)

**NOT AVAILABLE**

### Pin 5 (Programmable Status Output 2)

**NOT AVAILABLE**

### Pin 6 (Ultrasound Active Status Output)

Pin 6 is a digital active low status output that activates when the system is delivering ultrasonic power to the load attached to the ultrasound output connector. This output will be an open circuit when the ultrasound output is off.

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**Pin 7 (Any Fault Status Output)**

Pin 7 is a digital active low status output that activates whenever any fault condition is detected that inhibits ultrasound output and normal system operation. This output will be an open circuit when no system fault conditions are detected.

Generator faults that will activate the Any Fault output:

- Overload – Peak
- Overload – Average
- Overload – Frequency
- Overtemperature Fault
- System Power Fault
- Current Loop Fault

**Pin 8 (Press Trigger Status Output)****NOT AVAILABLE****Pin 9 (System Overload Status Output)**

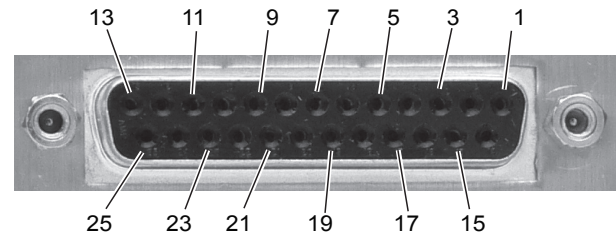
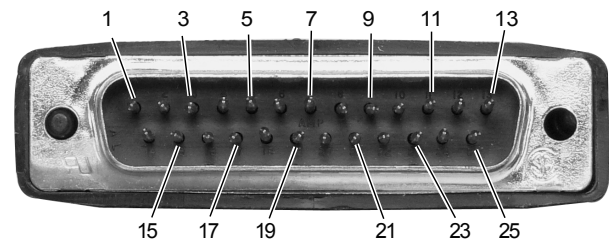
Pin 9 is a digital active low status output that activates whenever any overload condition is tripped. Activation of the overload status output signal could be caused by an average overload, a frequency overload or, a peak overload condition. After the overload status output activates, it will remain active until the next ultrasound activation cycle begins and this output will automatically reset. This output will be an open circuit when no overload conditions have been detected.

**Pin 10 (System On-Line Status Output)**

Pin 10 is a digital active low status output that activates when the system is in the ONLINE operating mode, which enables the activation of the ultrasonic output. This output will be an open circuit if the system is switched to the OFFLINE operating mode, which will prevent the start of a welding cycle or activation of the ultrasound output. Note that an automation controlled process can not weld any parts, if the system is, accidentally or otherwise, switched to the OFFLINE operating mode.

**Pin 11 (Press Top of Stroke Status Output)****NOT AVAILABLE****Pin 12 (Current Loop OK Status Output)**

This status output signal will activate only when a Remote Control Board is installed in the system. Pin 12 is a digital active low status output that activates when the

**Figure 4-6** DB 25-F for Generator Output Connector**Figure 4-7** DB-25M for Generator Output Cable Connector

current loop input to the remote control option board is connected and working normally. This output will be an open circuit when the current loop input signal is too low for proper system operation (less than 2mA). This may be due to a broken wire connection, a failed current loop controller or the current loop input wired incorrectly to the input terminal block.

**NOTE**

*A Remote Control Board is also referred to as a Remote Amplitude Control Board.*

**Pin 13 (Analog Monitor Signal Common)**

Pin 13 is the signal common (ground) connection for all of the analog monitor signals (on Pins 15 and 16). This signal common pin is connected to system chassis ground and is not isolated from the generator chassis. This is an analog signal ground connection. Do not connect anything to this ground connection, except the wiring to the inputs of the analog instrumentation devices used to measure the monitor output signals.

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#### **Pin 14 (Not Used)**

Pin 14 is connected to the system chassis ground.

#### **Pin 15 (Power Signal Monitor Output)**

Pin 15 is an analog output signal used to monitor the power output from the welding system. The scaling on this output signal is as shown below:

15kHz, 20kHz, 30kHz and 40kHz systems

1 Watt = 0.001 VDC (1 mV per Watt)

50kHz and higher systems

1 Watt = 0.010 VDC (10 mV per Watt)

Examples: 20kHz system measures 0.525 VDC on  
Power Monitor Output = 525 Watts

50kHz system measures 0.525 VDC on  
Power Monitor Output = 52.5 Watts

#### **Pin 16 (Amplitude Monitor Output)**

Pin 16 is an analog output signal used to monitor the system amplitude setting. The scaling on this output signal is 100% amplitude = 10.0 VDC, or 0.1 VDC per 1% amplitude. This monitor signal output would typically be used when a remote control option board is installed in the system. The automation control system will adjust the system's amplitude setting remotely, using a 4-20mA current loop attached to the input of the remote control board. Using this monitor output, the control system can verify that the amplitude is set to the expected programmed amplitude level.

#### **Pin 17 (Amplitude/Power Regulation Status Output) (Subject to availability)**

This status signal is most useful when the power regulation mode is selected. This Out of Regulation status signal would indicate that due to inadequate pressure against the ultrasonic horn, the power regulation level setting can not be achieved when the amplitude level is set to the maximum level of 100%.

In the amplitude regulation mode, this signal will be activated at the end of the ramp-up time until the beginning of the ramp-down time. This status signal will be active for the time the ultrasound is at the programmed amplitude setting.

Pin 17 is a digital active low status output that activates when the system is regulating the amplitude or power level correctly. This output becomes an open circuit when

the system falls out of regulation. When that happens, it cannot adjust the system output to the output level that was programmed as the regulation set point.

#### **Pin 18 (MPC Ready Status Output)**

This status output signal will activate only when an MPC interface board is installed in the generator. Pin 18 is a digital active low status output that activates when the MPC controller is ready to accept changes on the probe selection control bits and ready to start the next MPC welding cycle. This output will be an open circuit when the MPC system is not ready to accept changes to control input signals.

Any changes will be ignored until this status output signal activates to the ready state. This status output signal will also be open (MPC NOT READY) if a fault condition is detected inside the MPC system. If this status output will not activate, check for a RED fault status indication on the front of the MPC system.

#### **Pin 19 (System Power OK Status Output)**

Pin 19 is a digital active low status output that activates when no fault conditions are detected by any of the power fault detection circuits included in the system. This output will be an open circuit when any power related fault is detected in the system.

#### **Pin 20 (Bad Part Status Output)**

**NOT AVAILABLE**

#### **Pin 21 (Good Part Status Output)**

**NOT AVAILABLE**

#### **Pin 22 (System Ready Status Output)**

This status output signal will activate only when the system is ready to activate ultrasound. Pin 22 is a digital active low status output that activates when a weld processing cycle is completed and the welding process control system is ready to start the next welding cycle. This output will be an open circuit when the welding process controller determines that the next welding cycle cannot be started which includes *ANY* process fault or set to OFFLINE mode.

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**Pin 23 (Suspect Part Status Output)****NOT AVAILABLE****Pin 24 (Isolated Common)**

Pin 24 is electrically isolated from chassis ground and is the default output configuration.

Connect this common line to the negative output on a user-provided isolated 24VDC power supply. The isolated NPN status output signals can drive PNP inputs.

**Pin 25 (Not Used)**

Pin 25 is an open connection.

**Ultrasound Output Connector**

The ultrasound output connector used with all standard generators is a high voltage (5000V) coaxial style SHV-BNC connector. This connector provides superior shielding of electrical noise, compared to other types of connectors. The ultrasound output connector mates with fully shielded coaxial ultrasound cables that are secured with a simple and reliable quarter-turn bayonet style attachment mechanism.

See the **CAUTION** statement to the right.

**Configuration Port Connector**

The configuration port connector is a DB-9M (standard D-subminiature 9-circuit male) typically used for RS-232 serial communications. This serial port (DTE) connects to a serial port (DCE) on a computer via a standard 9-pin serial cable. If the computer does not have a serial port, you may use a USB-to-serial conversion cable.

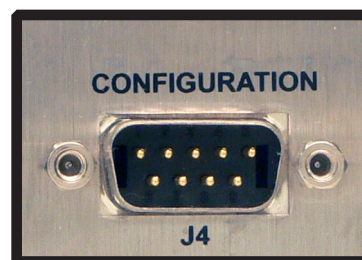
This port is used for field updates to the generator firmware, without removing the enclosure cover.™ This port can also be used by automated equipment to communicate with the generator via Dukane's *iQLinQ* RS-232 protocol. Refer to *Section 10, Options* for information about *iQLinQ*.

**Figure 4-8** Ultrasound Output Connector**CAUTION**

The ultrasonic output from this connector (that drives the attached ultrasonic load) is a very high AC voltage. At high power levels this can exceed

2 amperes of current and must be securely terminated via the ultrasound cable for safe operation. Use original equipment ultrasound cables for safe and reliable system operation. Improperly assembled ultrasound cables can result in high voltage arcing and will destroy the ultrasound connectors.

Do not use your generator if there is any evidence of arcing (black carbon deposits) on either the ultrasound output connector or the ultrasound cable connectors.

**Figure 4-9** Configuration Port Connector

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# SECTION 5

## Standard System Status and Controls

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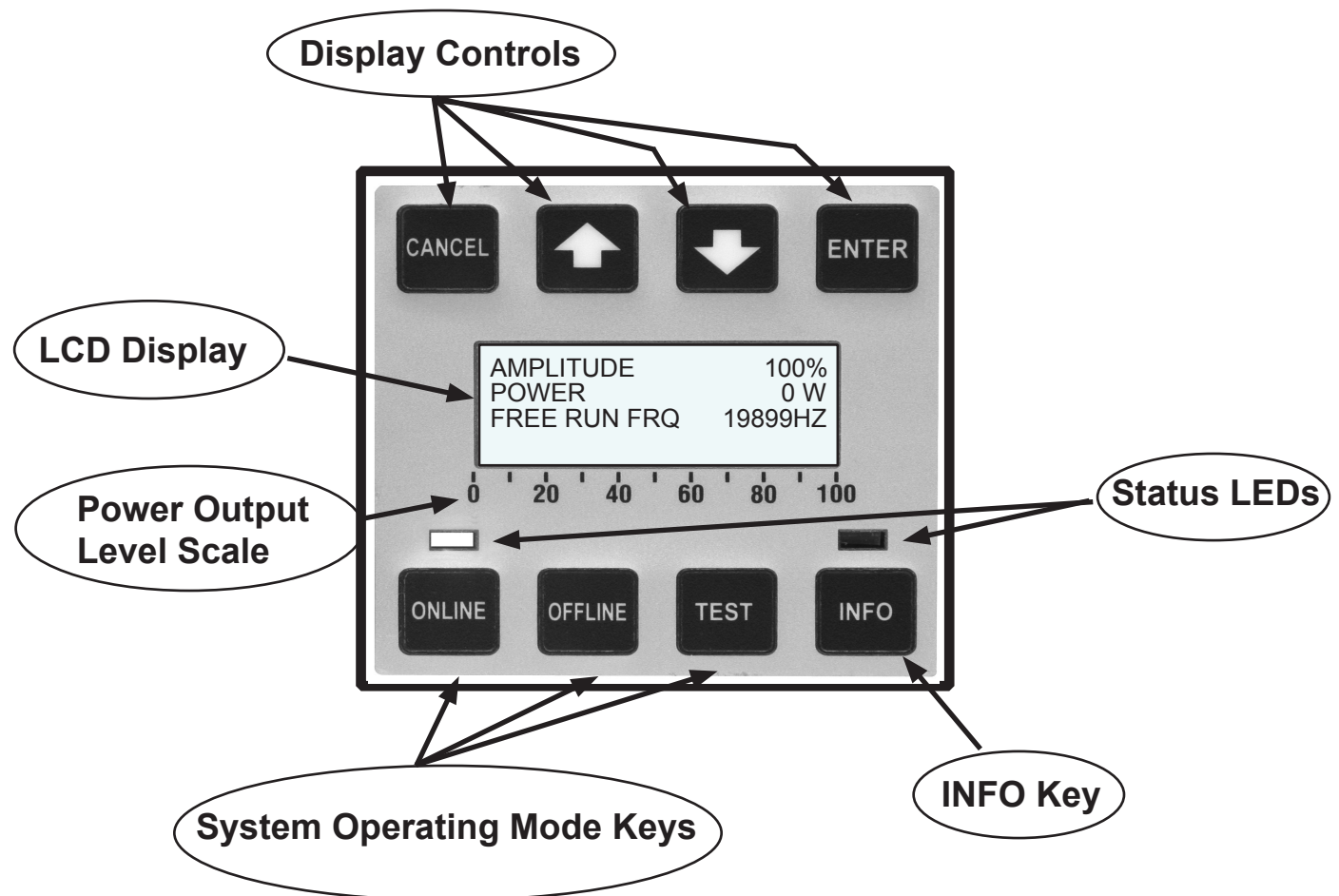
## Control Panel and Display

### Overview

This section provides an overview of the control panel and display. The panel has two functions:

- 1) monitoring, using the LED status lights, and
- 2) display and control, using the Display Controls with the LCD display.

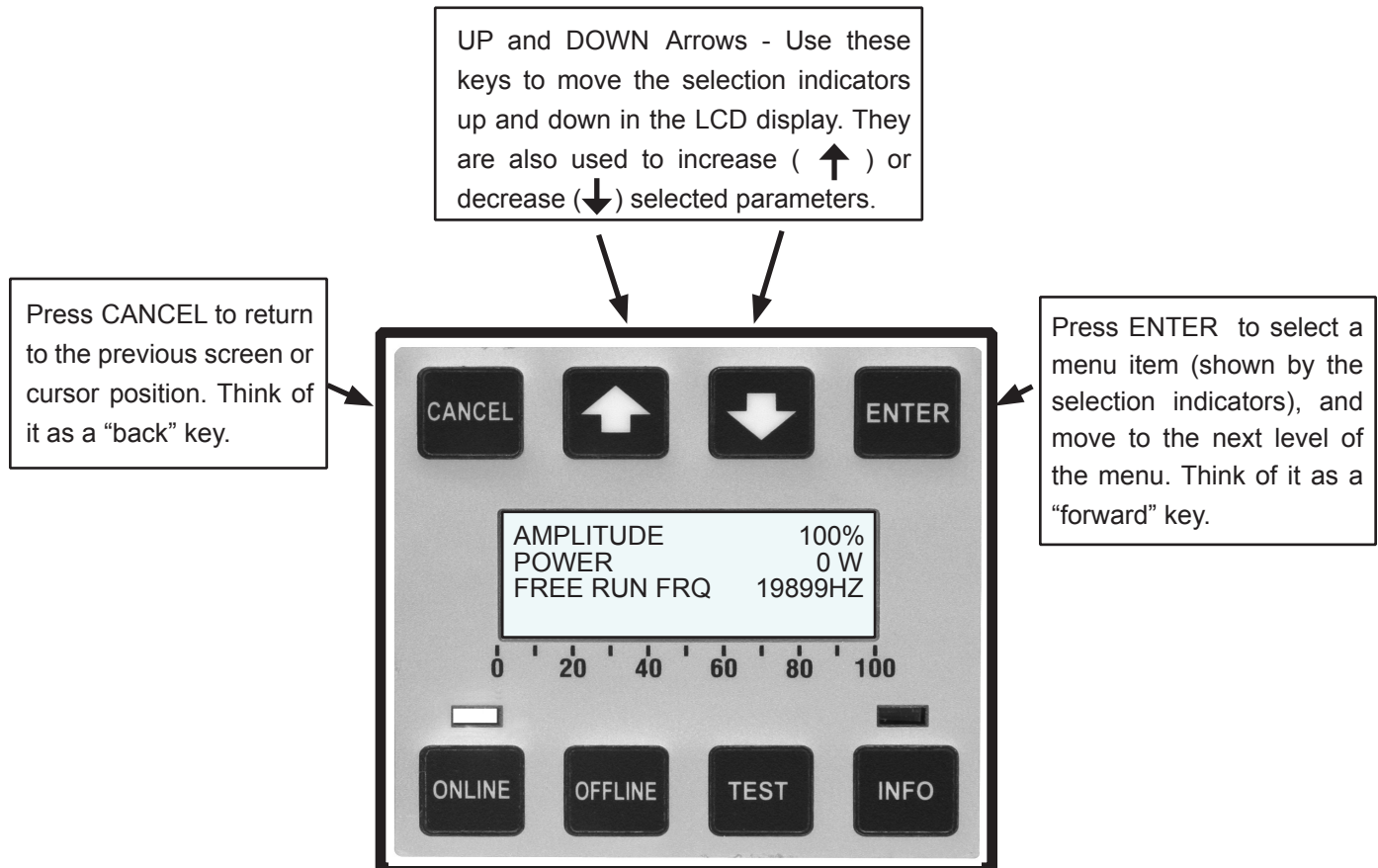
Figure 5-1 identifies the primary parts of the panel that are described in the pages that follow.



**Figure 5-1** Control Panel and Display

## Display Controls

The four keys on the top of the panel provide control for the LCD display.



**Figure 5-2** Control Panel Display Controls

## LCD Display

The 4-line LCD display gives the operator a basic interface for generator monitoring and control.

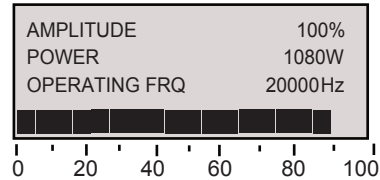
Figure 5-3 illustrates a typical view of the display just after the generator has been powered up.

AMPLITUDE	100%
POWER	0W
FREE RUN FRQ	19899HZ

**Figure 5-3** Display After Power-up

## Power Output Level Scale

Figure 5-4 shows what a display might show when the TEST key is pressed. In this example, the generator is producing an ultrasound signal at approximately 90% of its capacity.



**Figure 5-4** Power Output Level Scale

## System Operating Mode Keys

The system operates in three basic modes:

ONLINE, OFFLINE, and TEST.

Figure 5-5 shows the mode keys at the bottom of the control/display panel. Also note the location of the left and right status LEDs.

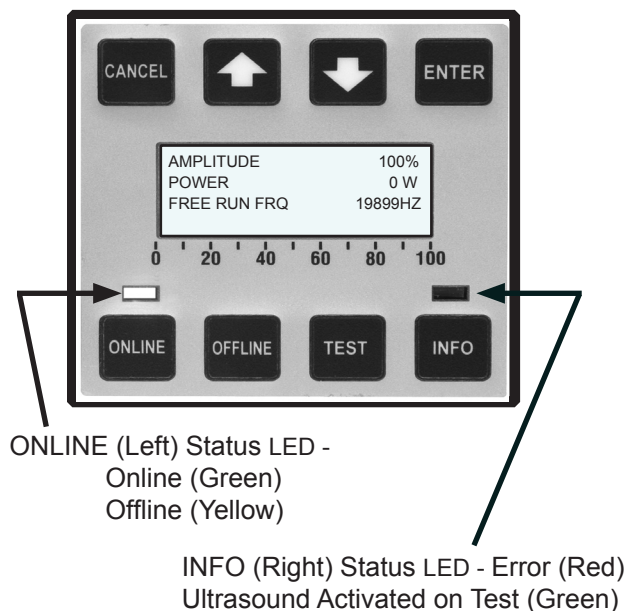
**ONLINE** - Press the ONLINE key to operate in the online mode.

In this mode, ultrasound can be activated. The LED above the ONLINE key is GREEN when the generator is online.

**OFFLINE** - Press the OFFLINE key to operate in the offline mode. Select this mode during your process setup or to cycle the assembly equipment without ultrasound activated.

In the offline mode, ultrasound can not be activated. The LED above the ONLINE key is YELLOW when the generator is offline.

**TEST** - Press the TEST key to operate in the test mode. In this mode, ultrasound output will activate for the time that the TEST key is pressed. In test mode, the right status LED changes from being GRAY (Off) to GREEN. This mode is typically used when setting up a welding application. It is not normally used during an actual welding process when products are being made.



**Figure 5-5** Operating Mode Keys and LEDs

### NOTE

Use the test mode only when:

- 1) The ONLINE GREEN LED indicates that the generator is online, **and**
- 2) When the ultrasound output cable at J1 is connected to a probe/stack.

## INFO Key

Press the INFO key.  
Figure 5-6 shows what the INFO display looks like.

## SYSTEM INFO

Select SYSTEM INFO (See the selection indicators shown in Figure 5-6.), and press ENTER to view:

- Firmware revision, and
- System identification including model number

See Figure 5-7 for a SYSTEM INFO example.

## OPERATE

Select OPERATE, and press ENTER to view:

- Amplitude,
- Power, and
- Free Run Frequency

These values reflect what the parameters were for the previous weld operation.

See Figure 5-8 for an example of the OPERATE display.

## AMPLITUDE

Select AMPLITUDE, and press ENTER to view, and to change the amplitude setting.

Amplitude is a value with a minimum of 20% and a maximum of 100%.

See Figure 5-9 for an example of the AMPLITUDE display. Use the UP and DOWN arrow keys to set the desired value.

Make the change, press ENTER, and ENTRY ACCEPTED will be displayed confirming that the change was made.



Figure 5-6 INFO Display

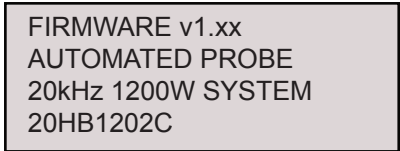


Figure 5-7 SYSTEM INFO Example Display

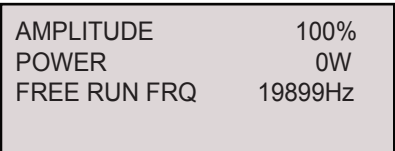


Figure 5-8 OPERATE Example Display

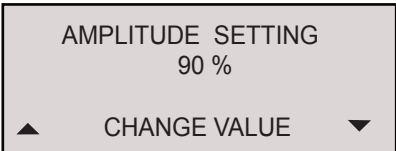


Figure 5-9 AMPLITUDE Example Display

**NOTE**

Pressing the UP arrow key when 100% is displayed will change the percentage to 20%.

Pressing the DOWN arrow key when 20% is displayed changes the percentage to 100%.



## Status LEDs

Status LEDs provide operating status for system power, the system operating mode and system output status as described below:

### **INFO** Status Indicator (*On the panel's right side*)

GREEN = Generator ultrasound output is activated.

RED = Could be due to one of the three conditions listed below:

#### **Red Fast Flashing** (4 flashes per second)

Indicates an under or over voltage condition in the AC line voltage connected to the generator. To operate, the generator needs AC line voltage to be within this range: minimum 180VAC; maximum 265VAC. (*This range is 10% below and 10% above - respectively - the nominal voltage requirement of 200-240 VAC.*) If this range is not maintained, a line voltage fault will inhibit system operation, and the INFO status indicator will flash approximately four times per second. This flashing may occur momentarily when the system power is switched off and does not indicate a problem or malfunction.

#### **RED Slow Flashing** (1 flash per second)

Indicates that the DC bus capacitors are not charged to the proper voltage level. This is a normal condition whenever the system is switched on. The DC bus capacitors will normally charge to the proper voltage level within 10 seconds. Then the ONLINE indicator should switch to a steady GREEN (if ONLINE), or YELLOW (if OFFLINE). If the slow flashing indication continues and does not stop, an internal problem is preventing the DC bus capacitors to charge to the proper voltage level. The system will require service, if this fault condition continues to flash and does not stop. Do not allow the system to operate in this fault condition for an extended period of time. There is likely a shorted internal component causing this type of fault condition, and some internal parts might get very hot as a result. If this fault occurs, switch the unit off, and

return the generator for service.

#### **Steady RED** (No flashing)

Indicates that there is a problem with one of the DC voltage outputs on the system control power supply. If this fault condition occurs, switch off the system power, and return the generator for service.

### **ONLINE** Status Indicator (*On the panel's left side*)

Status Indicator

GREEN = ONLINE

Generator ultrasound output is activated.

YELLOW = OFFLINE

Some system fault conditions will reset automatically. A system overload inhibits the ultrasound output when it occurs, but will automatically reset when the next ultrasound activation signal begins.

If an overtemperature condition is the cause of the fault indication, the fault condition will automatically reset when the system cools. Most other system fault conditions will not reset. In those cases the generator needs servicing.

### **NOTE**

A welding cycle cannot be started when the mode is OFFLINE because this blocks the ultrasound activation signal input.

## System Parameter Settings

This section provides the default system settings made at the factory. Some of these system parameter settings are dependent on the nominal system operating frequency while other parameters are independent of the frequency. The default settings should perform in an acceptable manner with over 90% of the ultrasonic loads and welding applications that might be encountered. In some cases, adjusting the system setup parameters might enable the system to drive difficult or unusual loads, which would not be possible with the standard system settings.

**NOTE**  
Consult the factory for customized settings.

### Default System Parameter Settings

#### Default Frequency Dependent Settings

Setting Description	15kHz	20kHz	30kHz	40kHz
Free Running Frequency Setting (Hz)	15,000	19,900	30,000	40,000
Maximum Frequency Limit Setting (Hz)	15,500	20,400	30,500	40,500
Minimum Frequency Limit Setting (Hz)	14,500	19,400	29,500	39,500
Ramp-up Time Setting (sec.)	0.250	0.150	0.100	0.050
Phase Delay Setting (degrees)	0°	0°	0°	0°

Table 5-I Default Frequency Dependent Settings

**NOTE**  
An ultrasonic stack will not operate if the mechanical resonance is outside the frequency limits.

# Section 6

## Process Control Settings

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## User-Provided Process Control Overview

This type of generator does not include a process control system for the welding process. The user must provide all of the system control signals to either manually control the welding process with a hand operated probe or by implementing a user-designed automated control system to control the welding process.

### Manual Welding

Generally, a trained operator will control the welding process using a hand probe with an activation switch that controls the duration of the ultrasonic energy applied to the parts that are being welded. The operator will apply an appropriate amount of pressure to the parts that are to be ultrasonically joined, then activate the ultrasound output for a time period that will reliably weld the final assembly. The quality of the finished product is determined by the skill of the hand probe operator.

### Automated Welding

This automated welding control approach is custom designed by the user and can be very simple or quite sophisticated, depending upon the user's requirements. In most cases, a Programmable Logic Control (PLC) system will be used to implement the required welding process controls. Output signals from the PLC system will determine when the ultrasound should be activated and when it should be shut off. Control signals for a Multiple Probe Control (MPC) system can also be easily added, if needed. A variety of ultrasonic welding status output signals are available to the automation system, which are useful to monitor the welding process.

## Automated Process Control Input Signals

Refer to Section 4 for the available input control signals on the system input connector. The ultrasound activation input will always be used, with the other available control input signals optional, depending upon the user's processing requirements. Note that some of the control inputs are not functional without a front panel processor or other optional feature. The Automation Stop input and the Remote Setup control inputs are available. The Auto Stop input provides an added means to shut off the ultrasound output, and the Remote Setup inputs allow welding with multiple probes, using an optional MPC system.

### Status Output Signals

Refer to Section 4 for the available status output signals on the system output connector. Note that some of the available status output signals are not functional without a front panel controller or other optional feature. Using the available status output signals, the automation system can easily monitor when the ultrasound output is activated and can monitor a majority of the fault status signals to assist in controlling the automated welding process.

## Programming Examples

This section gives you a step-by-step guide to navigating through some of the basic menu structure. Programming examples cover how to:

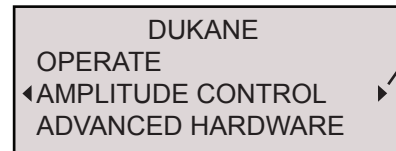
- **Adjust Amplitude**
- **Adjust Ramp Up Time (Soft Start)**
- **Adjust Ramp Down Time (Soft Stop)**
- **Adjust Advanced Hardware Settings**

### HOW TO - Adjust Amplitude

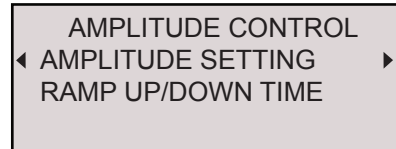
1. Press **CANCEL** until you see the Main Menu screen as it is shown here. \_\_\_\_\_

Move the selection indicator to **AMPLITUDE CONTROL**. Press **ENTER**.

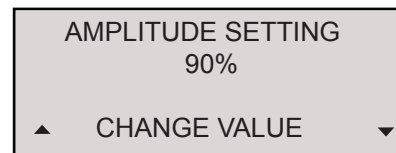
2. You will see the screen as shown here. \_\_\_\_\_



Selection Indicator



3. Press **ENTER**, and you will see the screen as shown here. \_\_\_\_\_



4. Adjust the amplitude. This is a value with a minimum of 20% and a maximum of 100%. Use the **UP** and **DOWN** arrows to change the value.

5. When done, press **ENTER**, and an **ENTRY ACCEPTED** message will appear.

#### NOTE

Once the amplitude is set and the entry is accepted, the program takes you back to the **AMPLITUDE CONTROL** screen. From there you may adjust the **RAMP UP/DOWN** times or go to some other part of the menu.

## HOW TO - Adjust Ramp Up/Down Times

The **Ramp Up feature**, also called **soft start**, applies amplitude at the beginning of the weld cycle to start the stack assembly (transducer, booster, horn) *linearly*, rather than in two instantaneous surges. The stack is brought up to operating amplitude smoothly, without shock stress.

Although the Ramp Up time is factory set, it is variable and can be adjusted to account for starting characteristics of a particular horn.

The Ramp Up setting depends on the generator load at the start of a cycle.

**Ramp Down**, or **soft stop**, decreases amplitude after the end of the weld cycle. The stack is brought down from its present weld amplitude, reducing shock stress.

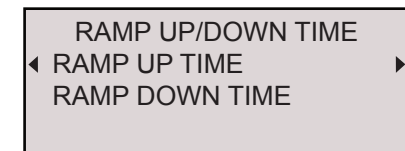
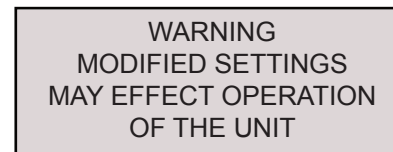
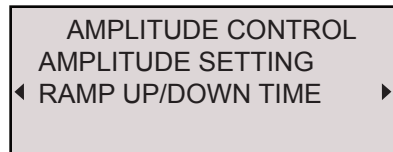
1. As in the previous HOW TO example, navigate to the **AMPLITUDE CONTROL** screen.
2. Select **RAMP UP/DOWN TIME**, and then press **ENTER**.
3. A **WARNING** will appear as shown to the right.  
*Call Dukane Service with any questions about making this adjustment.*
4. Select the feature (Ramp Up Time or Ramp Down Time) you want to adjust.  
Adjust ramp up/down times. See the table below.  
Use the **UP** and **DOWN** arrows to select the value.

Feature	Seconds	
	Max	Min
Ramp Up	1.250	0.020
Ramp Down	0.250	0.000

**Table 6-1** Ramp Up/Down Times

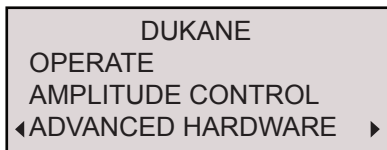
When done with the entry, press **ENTER**, and the **ENTRY ACCEPTED** message will appear.

The program will take you back to the **AMPLITUDE CONTROL** screen.

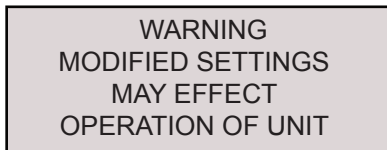


## HOW TO - Adjust Advanced Hardware Settings

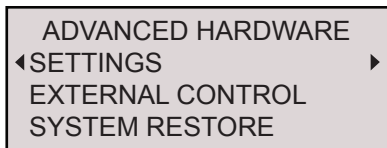
1. Press **CANCEL** until you see the Main Menu screen as it is shown here. Move the selection indicator to **ADVANCED HARDWARE**.



2. Press **ENTER** and you will see the screen as shown here.



3. After a few seconds the **WARNING** message ends, and the main Advanced Hardware screen appears as shown to the right. Select **SETTINGS**.

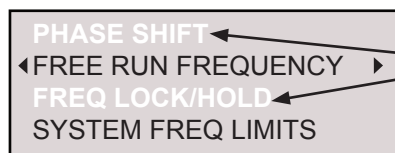


Adjust Free Run Frequency or System Frequency Limits.

Contact Dukane if it becomes necessary to adjust Phase Shift or Frequency Lock/Hold.

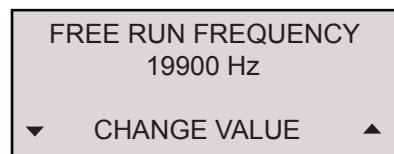
### NOTE

For more information about Frequency Lock and Hold, reference Dukane's Application Note 505 at: [http://www.dukane.com/us/DL\\_ApplData.asp](http://www.dukane.com/us/DL_ApplData.asp)



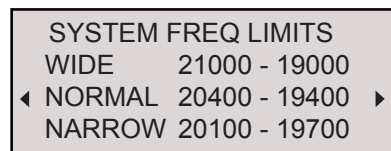
Contact Dukane for proper use of these settings.

4. **FREE RUN FREQUENCY** - Change the value, and Press **ENTER**. The **ENTRY ACCEPTED** message will appear.



**Free Run Frequency** - This is the frequency at which the generator drives the ultrasound output pulses until the actual operating frequency is detected. Typically this value is below the operating frequency of the acoustic stack.

5. **SYSTEM FREQUENCY LIMITS** - Select the range, Wide, Normal, or Narrow. Press **ENTER**. The **ENTRY ACCEPTED** message will appear.



### System Frequency Limits

Wide: Upper and lower limits are set to the maximum and minimum frequencies for the generator.

Normal: Upper and lower frequency limits equal the free run frequency  $\pm$  (above or below) 500Hz.

Narrow: Upper and lower frequency limits equal the free run frequency  $\pm$  (above or below) 200Hz.



# SECTION 7

## System Operational Testing

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## System Verification Tests

### Preliminary Setup

1. Plug in the AC line cord to the correct AC power outlet. See Table 11 -I for the AC power requirements.
2. Attach a compatible ultrasonic probe to the system output connector.
3. Push the AC Breaker/Switch **A** to the ON position.

### Testing a System

(Complete Steps 1-3 above, and then continue with Steps 4 and 5 below.)

4. The INFO LED on the panel **B** should flash RED for 5–10 seconds. Then, it turns off (GRAY), and the LED above ONLINE **C** turns GREEN (if ONLINE).

#### 5. ONLINE/OFFLINE Tests

- a. Press the OFFLINE key.

The LED status indicator **C** turns to YELLOW.

- b. Press the TEST key.

The ultrasound should not activate.

- c. Press the ONLINE key.

The LED status indicator **C** will be GREEN.

- d. Press and hold the TEST key. Ultrasound should activate. The display shows amplitude, power and operating frequency. The segmented power bar graph should also appear.

See the sample screen display - Figure 7-2.

Release the TEST key.

Ultrasound should deactivate.

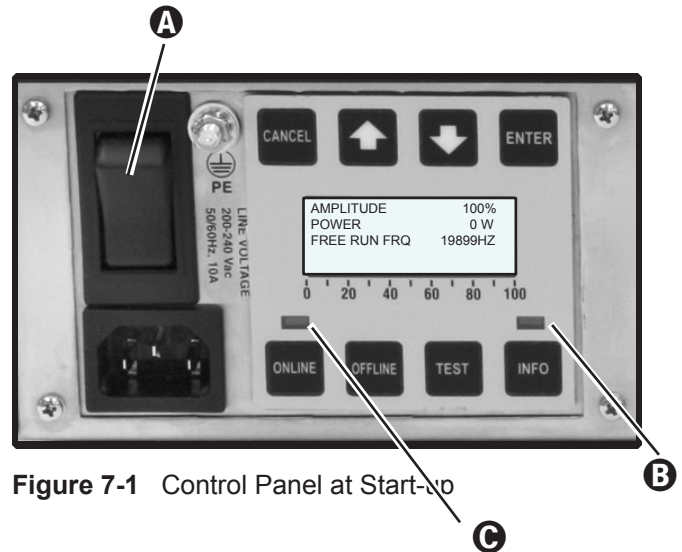


Figure 7-1 Control Panel at Start-up

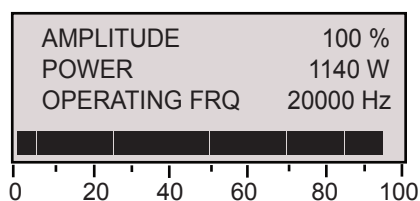


Figure 7-2 TEST Screen Display Sample

## System Test

To test the system's ultrasound operation, perform the following five steps.

1. With the generator OFFLINE (LED **C** is YELLOW - Figure 7-3), connect a probe to the generator ultrasonic output.
2. For this test, the generator must be online. If the LED above the ONLINE key is YELLOW, (**C** in Figure 7-3), press the ONLINE key. The LED should now turn GREEN.
3. Place the probe so the tip of horn is not in contact with anything.
4. Momentarily press the TEST key.

If you are using a hand probe, you may feel a slight vibration or sensation in your hand. This is normal. There should not be any loud or unusual noise.

5. The LED **B** turns GREEN.

The probe will operate as long as the TEST key is pressed.

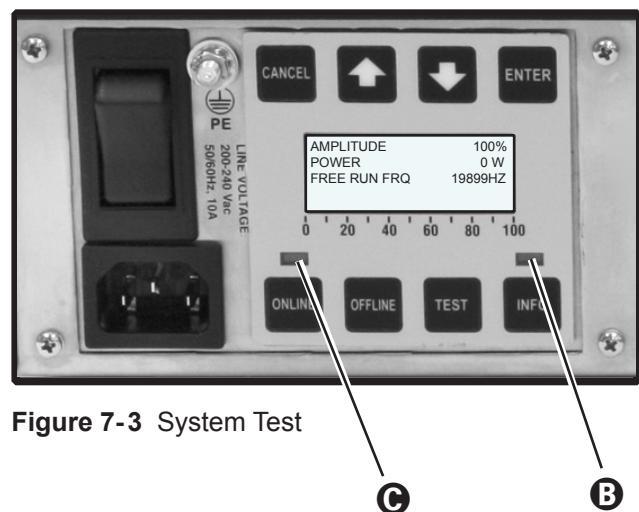
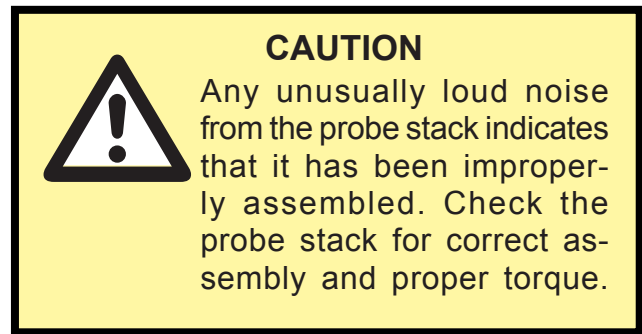


Figure 7-3 System Test

## Probe Operation

1. If the generator is not online, press the **ONLINE** key. The **ONLINE** LED status indicator should be green.  
(**C** in Figure 7-3)
2. Hand Probe – Apply the probe tip to the components to be ultrasonically joined, and press the hand probe's activation switch.  
  
Hold the probe's activation switch for the appropriate amount of time to achieve the desired assembly results.
3. Automation System – Press the automation system's activation switch to trigger the generator. This allows the probe tip to move in contact with the components to be ultrasonically joined.

Weld time is controlled by the automation system.

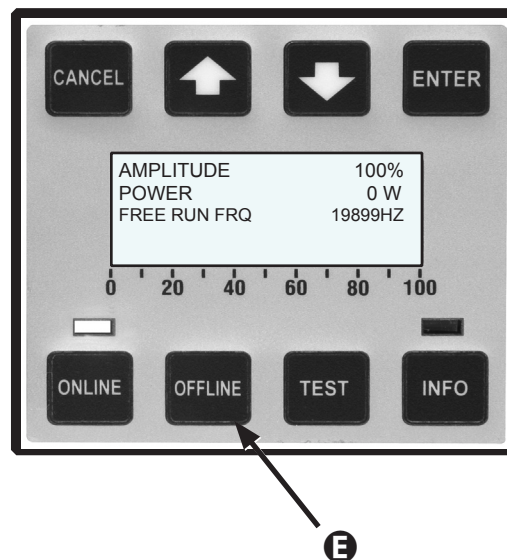
### NOTE

Then generator must be online (the **ONLINE** status LED will be green) before an ultrasound signal can be generated.

Neither a hand probe or an automation system can trigger the generator to produce an ultrasound output if the generator is **OFFLINE**.

## Stop Ultrasound Output

Press the OFFLINE key (**E** in Figure 7-4), and the ultrasound signal will deactivate.



**Figure 7-4** Stop Ultrasound Output

# SECTION 8

## Troubleshooting

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## No Ultrasonic Output

### Probe

Make sure that the probe coaxial cable is connected to the generator ultrasonic output connector J1. Both horizontal and vertical chassis models have the BNC connector on the front panel. Also, make sure the probe stack was properly assembled.

### Cables

Make sure that both the U/S coaxial and system I/O cables are securely connected. You must have an operate trigger input to Pin 8 on the system input HD-15 connector either by the hand probe's control cable or by custom automation. Refer to Table 4-I, Generator Input Signals, for details.

Place the generator OFFLINE, and:

1. Check the coaxial cable for any signs of damage that may result in an open circuit preventing the cable from transmitting the generator-to-probe signal.
2. If you have a mounted probe, replace the coaxial cable with a known good cable.
3. If you are using a hand probe, try a different known good probe to determine if the problem is related to the generator or to the external cables and probe.

### Generator

The generator will not produce an output signal when triggered if it is offline. Make sure that the ONLINE status LED is GREEN.

If the generator is OFFLINE, press the ONLINE key. (See Figure 8-2.)

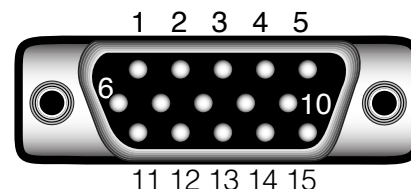
### Operate Input

If you are using a hand probe, make sure the control cable and adapter cable are securely connected to the system I/O connector. The trigger switch on the hand probe activates the ultrasonic output through the control cable.

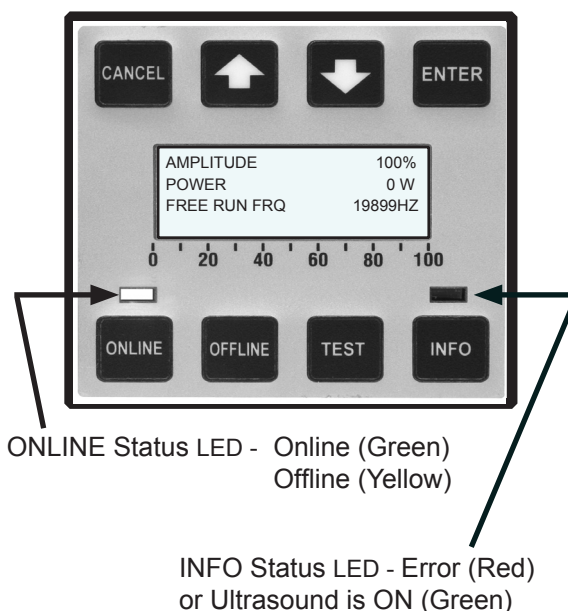
### NOTE

The cable end of the system I/O connector is a mirror image of the panel connector. Figure 8-1 below shows the cable pinout. Make sure you have correctly wired the connector if you are using custom automation signals.

Also refer to Table 4-II for the cable color pin assignment.



**Figure 8-1** Cable End of System I/O Connector



**Figure 8-2** Status LEDs

## INFO Status LED: RED

### RED - Fault Condition

When the INFO status LED is RED (Figure 8-2) there is a fault condition.

### Overloads

#### Overload-Frequency

There are two types of Overload-Frequency faults:

- Frequency Failed**, and
- Frequency Lost**.

Other overloads are:

Overload-Peak, and

Overload-Average (power above rating)

When an overload occurs, it will automatically reset when the next ultrasound activation (Auto-In) signal begins.

If the condition persists, put the generator OFFLINE and:

1. Check the system: including cables, the acoustic stack, mounted probe, and/or hand probe. Replace existing components with ones you know are reliable.
2. Press the ONLINE key to place the generator online, and see if the fault condition has been corrected.

### Overtemperature

When the system overheats, there is an overtemperature condition that will cause the fault. When the system cools, the system automatically resets.

### Generator Fault Does Not Reset

When the system does not automatically reset, the generator needs servicing.

#### NOTE

Be sure to press the ENTER key to clear the fault message and the INFO status LED.

The System Latch Reset Input will only clear the Output I/O faults.

If a fault occurs while using the TEST key, the TEST key will not function again until the ENTER key has first been pressed (to clear the fault message).

## Welding Problems

### Weak Welds

Weak welds or under welding is caused by insufficient energy being transmitted to the part. You can increase the weld pressure, increase the weld time or change to a higher gain booster to increase the amplitude.

### Excess Flash

The energy director may be too large. Try reducing the weld pressure and/or the weld time. The parts may have too much shear interferences or they may have a nonuniform joint dimension.

### Inconsistent Welds

Variations in plastic due to the presence of filler materials and moisture absorption may lead to inconsistent welds. Fillers can be especially troublesome if:

- they are not uniformly distributed within the plastic,
- they make up too high a percentage of the plastic content, or
- regrind or degraded plastic content is of low quality or makes up too much of the filler.

Check the horn and fixture alignment and parallelism.

Check the alignment of the mating parts, shifting during welding or residual mold release on the parts.

There should be no unusual or loud noise from the acoustic stack. If there is, disassemble the stack and reassemble.

Exchange the probe with another unit to see if the problem disappears. If not, exchange the generator with another unit to try isolating the problem.

The horn amplitude may not be uniform if it has been machined, altered or damaged. All of these things will change the resonant frequency of the horn.

In addition, you may want to have the horn analyzed.

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# SECTION 9

## Maintenance

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## Display/Control Panel

### Cleaning

- Do not use any solvents or abrasive cleaners on the LCD panel.
- Do not spray any cleaning product directly on the panel.

To remove dust, first try gently dusting with a microfiber cleaning cloth. If further cleaning is needed, apply a small amount of screen cleaner to a soft microfiber cloth. Then, clean the panel/LCD display with the moistened cloth.

### Screen Cleaning Solutions:

*Make your own: Mix distilled water and white vinegar in 1 to 1 proportions. Pour this mixture into a spray bottle from which it can be used, or*

*Buy a cleaning solution: There are several on the market suitable for cleaning LCD screens.*

- Do not spray or apply cleaner directly on the generator.
- Do not allow any liquid to collect around the AC power switch.

### Display

Do not apply any pressure to the display.

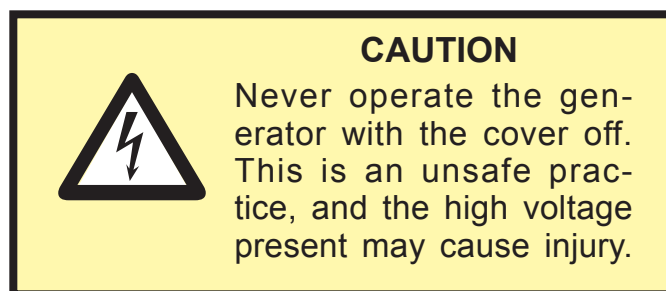
### Control Keys/Buttons

Control keys/buttons will respond to firm, gentle finger pressure. Please do not use sharp objects on the keys/buttons.

## Chassis

### Sheet Metal Cover

The cover is preformed to fit over the chassis and has protective grills over the cooling air vents. Keep the cover on at all times because there are high voltages present, and they could cause injury. The internal case also contains capacitors which continue to hold a high electrical charge, even after the power is shut off.



*Continued*

## **Air Ventilation Slots**

Keep the ventilation slots free from obstructions. If excessive dust or dirt collects on the slots, wipe or vacuum them clean. Do not use compressed air to clean them as this may force the dirt inside the chassis.

Allow 5 inches (127 mm) of clearance outside each ventilation slot.

On the vertical chassis, the air intake is on the bottom, and the exhaust is on the top of the unit.

See Figure 3-3, Page 15.

On the horizontal chassis, the air intake is on the left, and the exhaust is on the right.

This is shown in Figure 3-4, Page 16.

## **I/O Connector**

The Input/Output connector has a pair of 4-40 threaded jack screws to secure the connector. Do not overtighten them.

## **AC Power Cord**

The AC power cord should be kept in good condition and free from any cuts. The AC plug should be straight with no bent prongs.



# SECTION 10

## Options

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This section of the User's Manual provides a general overview of some options/upgrades, all of which are subject to availability, for the basic ultrasonic generator.

## Power Inlet Options

### 120V Systems for North America and Japan

120V systems for North America and Japan have a fixed power cord.

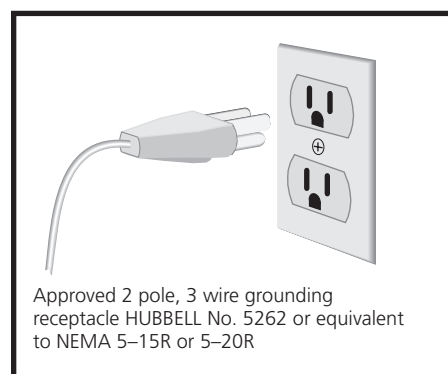
This option is available on generators with power ratings of 1200 watts or less and with operating frequencies of 20kHz, 30kHz, or 40kHz.

See Table 11-I, AC Power Requirements, in *Section 11, Specifications*.

## Electrical Safety

### 120V Power Ground

For safety, the power cords used on all Dukane products have a three-prong, grounding-type plug.



**Figure 10-1** Example of 120 Volt, Grounded, 3-Prong Receptacle

### CAUTION



If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply.

### CAUTION



If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

## AC Power Inlet Panel

The optional AC power inlet panel is described here.

### AC Power Inlet Connector

The AC power cord **A** below in Figure 10-2 is appropriately rated and permanently mounted to the power inlet panel.

### Power Switch/Circuit Breaker

The power switch/circuit breaker **B** in Figure 10-2 has a rocker type actuator switch that will activate or deactivate the AC power to the system. The power ON position is marked with the internationally recognized **I** symbol, the power OFF position is marked with the **0** symbol. This power switch also integrates an appropriately sized over-current protection circuit breaker function in the generator.

If an over-current condition trips the circuit breaker, it will automatically switch to the OFF position. If the overload current that caused the circuit breaker to trip is due to a transient condition, the circuit breaker can be reset by switching the actuator back to the ON position. If when resetting the circuit breaker after it has tripped, it immediately trips again, there is likely an internal system malfunction, and the generator will require service.

Do not repeatedly try to reset the circuit breaker. If it trips, this will only cause more damage to the generator.

### Chassis Ground Stud

The chassis ground stud is used to attach a protective earth ground to the generator. This will aid in the suppression of electrical interference or radio frequency interference (RFI) that is common in a industrial environment. The chassis ground stud is **C** in Figure 10-2. Proper system grounding is discussed in Section 3.

## Terminal Block AC Line Connection

Vertical panel mount units are optionally available with a terminal strip to connect a user-supplied AC power cord, instead of an IEC Power Inlet connector. Secure the user-supplied power cord to the terminal strip, and attach the other end to an approved AC source connection or outlet.

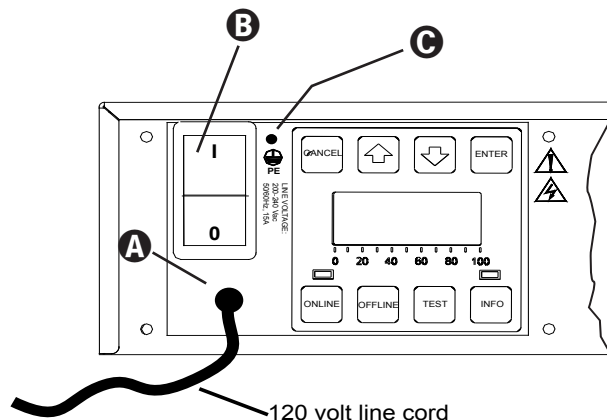


Figure 10-2 120VAC Power Inlet Panel

## I/O Panel Options

### Single I/O Connector

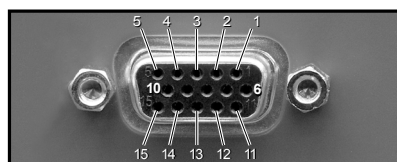
See **B** in Figure 10-4 where the I/O panel is set up for the single I/O connector, a HD15F type. The generator label for this connector is, **SYSTEM INPUTS/OUTPUTS**. Another label identifies the connector as J12.

The I/O panel can be customized with multiple types of connectors such as the single HD15F, terminal blocks, etc.

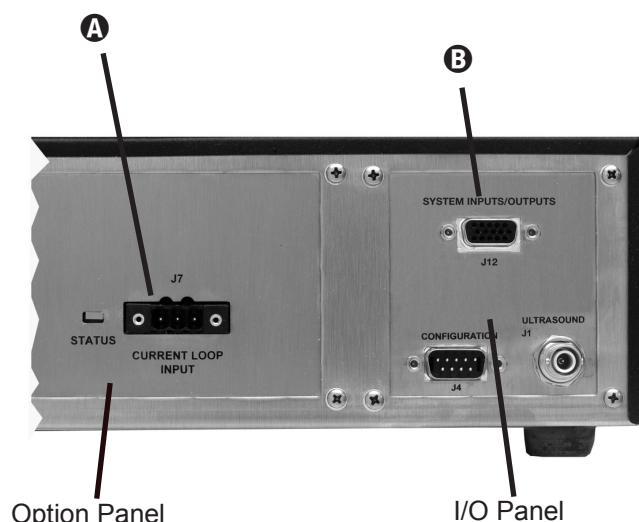
Contact your local sales representative for more details.

Table 10-I shows an example of a customized option:

Pins/Signals duplicate a Dukane DPC-I generator.



**Figure 10-3** HD-15F for System Inputs/Outputs Connector



**Figure 10-4** Option Panel and I/O Panel

(NOTE: Shown are the Option panel with Remote Amplitude Control Module, and the I/O panel with a single I/O connector.)

Pin	Signal Name	Signal Description
1	+ 22VDC	Current limited to 250 mA maximum
2	Ground	22VDC Return (chassis ground)
3	Ground	Status Outputs/Driver/Monitor Return
4	Status Driver	STATUS Driver Output (1 Amp max.)
5	Ultrasound Active Status	Ultrasound Statup Output (Active Low)
6	Overload Fault Status	Overload Fault Output (Active Low)
7	Isolated Common	Isolated Operate Input Common (7 & 8) JU726
8	Operate Input	Sw Closure Operate Input (2 & 8)JU724/725
9	Overtemperature Fault	Overtemperature Fault Output (Active Low)
10	System Fault	System Fault Output (Active Low)
11	Not Used	Reserved - HPPI Signal
12	Amplitude Setting	Amplitude Setting Monitor (10.0V = 100%)
13	Power Signal Common	Power Signal Common
14	Power Signal*	Power Signal Monitor Output* (1mV = 1 Watt)
15	Loop Fault	Current Loop Fault Output (Active Low)

\* Power Signal Output Monitor (Pin 14) is available only if the generator is equipped with the optional Power Signal Board.

**Table 10-I** HD15F Example of Customized System Inputs/Outputs Connector Signals

## Option Panel Modules

A single optional module can be installed in the *iQ* generator's Option Module Panel. See **A** in Figure 10-4 where the option panel is set up for a Remote Control Module.

### Multi-Probe Control (MPC) Interface Option Part Number - 110-4251

The *iQ* generator can be configured with an optional MPC Interface circuit board that powers and controls an external MPC multi-probe control module. This external module, (that can be ordered with a minimum of two probe controls up to a maximum of 16), must be purchased in addition to a basic generator for a fully functional MPC system.

The connections needed for the MPC Interface circuit board and the external MPC module are described below.

#### Optional MPC Interface Connections

Complete Steps 1 - 4 of the basic connections as described on Pages 18-19. These involve:

- Grounding (optional),
- Ultrasound Output,
- System Control Inputs/Status Outputs, and
- AC Line Input.

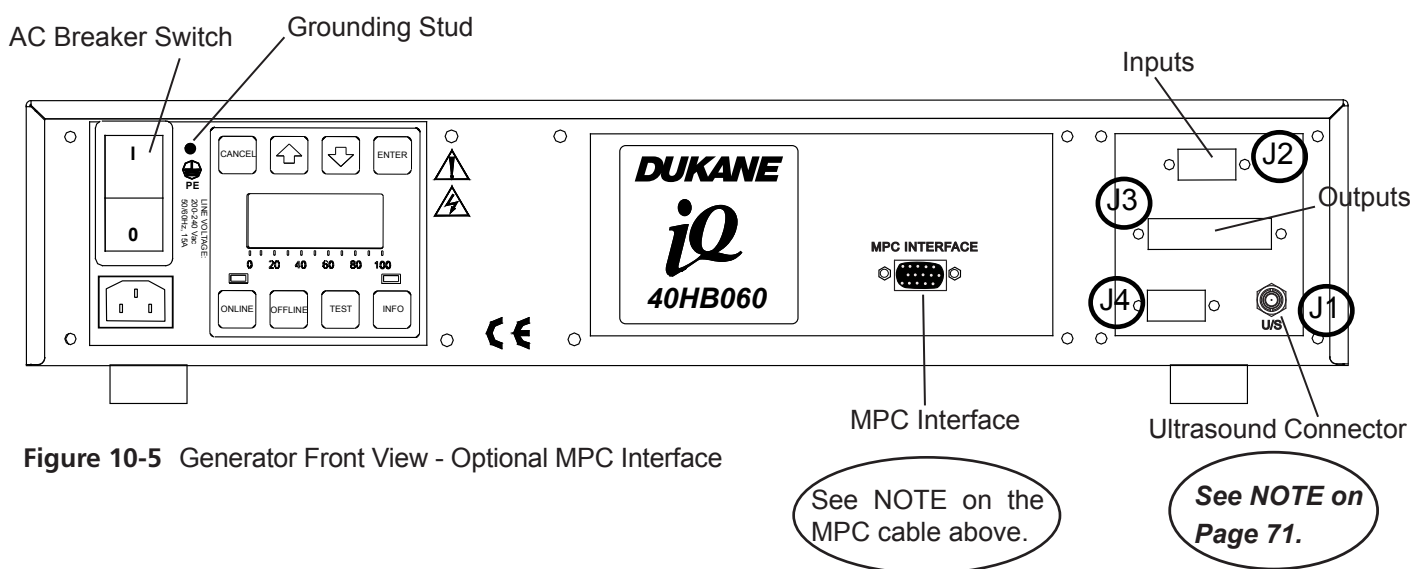
In addition to completing these first four Steps, complete Steps 5 and 6 to wire the MPC Control Inputs/Status Outputs as described below.

Details about the various system connectors and their pin assignments are covered below.

5. MPC I/O - MPC control/input signals and status output signals are carried in the I/O cables that should already be connected - See Inputs (J2) and Outputs (J3) in Figure 10-5.
6. MPC INTERFACE - Attach one end of the MPC Interface cable (Dukane # 200-1408-XX) to the MPC Interface connector on the *iQ* generator panel - MPC INTERFACE in Figure 10-5. Connect the other end of the cable to the MPC INTERFACE connector on the right rear of the MPC module.

#### NOTE

The MPC Interface cable is a separate line item on the *iQ* generator system order. The -XX at the end of the cable number specifies cable length. This will vary depending on your MPC installation.



*Continued*

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## MPC I/O Connections

Signal names and Pin numbers and the connectors related to the MPC option are shown in the table below. See the pages referred to in the table for more information about the signals.

Pin	Signal Name	Connector
3	Setup Bit 0 Input	J2 (Pages 26-27)
4	Setup Bit 1 Input	
5	Setup Bit 2 Input	
6	Setup Bit 3 Input	
18	MPC Ready Out	J3 (Page 32)

**Table 10-II** MPC I/O Connector Signals

## MPC Probe Control

When the optional MPC Interface and MPC I/O connectors are used, the generator has the capability of controlling as many as sixteen compatible probes. One probe can be turned on at a time while the sequence of probe activation is determined by the user's automation. The table below shows how the setup bit inputs correspond to the probes.

MPC				Probe Selected
3	2	1	0	
Off	Off	Off	Off	1
Off	Off	Off	On	2
Off	Off	On	Off	3
Off	Off	On	On	4
Off	On	Off	Off	5
Off	On	Off	On	6
Off	On	On	Off	7
Off	On	On	On	8
On	Off	Off	Off	9
On	Off	Off	On	10
On	Off	On	Off	11
On	Off	On	On	12
On	On	Off	Off	13
On	On	Off	On	14
On	On	On	Off	15
On	On	On	On	16

**Table 10-III** MPC Setup Bit Inputs

## NOTE

### Ultrasound Output Connector

The ultrasound output connector used with all standard generators is a high voltage (5000V) coaxial style SHV-BNC connector. This connector provides superior shielding of electrical noise, compared to other types of connectors. The ultrasound output connector mates with fully shielded coaxial ultrasound cables that are secured with a simple and reliable quarter-turn bayonet style attachment mechanism.

The ultrasonic output from this connector (that drives the attached ultrasonic load) is a very high AC voltage. At high power levels this can exceed 2 amps of current and must be securely terminated via the ultrasound cable for safe operation. Use original equipment ultrasound cables for safe and reliable system operation. Improperly assembled ultrasound cables can result in high voltage arcing and will destroy the ultrasound connectors.

Continued

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MPC Interface Installation Guide

The MPC interface is designed for assembly systems where one ultrasonic generator is sequenced to as many as 16 ultrasonic probes.

The MPC interface is typically supplied as a stand-alone bench-top unit, or as a component that can be mounted in a through-panel configuration.

No special installation is needed for a stand-alone MPC interface that can be put on a bench top or a shelf.

Use the following installation recommendations for a panel mounted MPC interface.

Cutouts

For panel mounted interfaces:

Use Figure 10-6 below to determine the size of the cutout needed for your equipment panel.

Make the appropriate cutout, and install the MPC interface securing the mounting flange to the equipment panel before continuing with the cable connections.

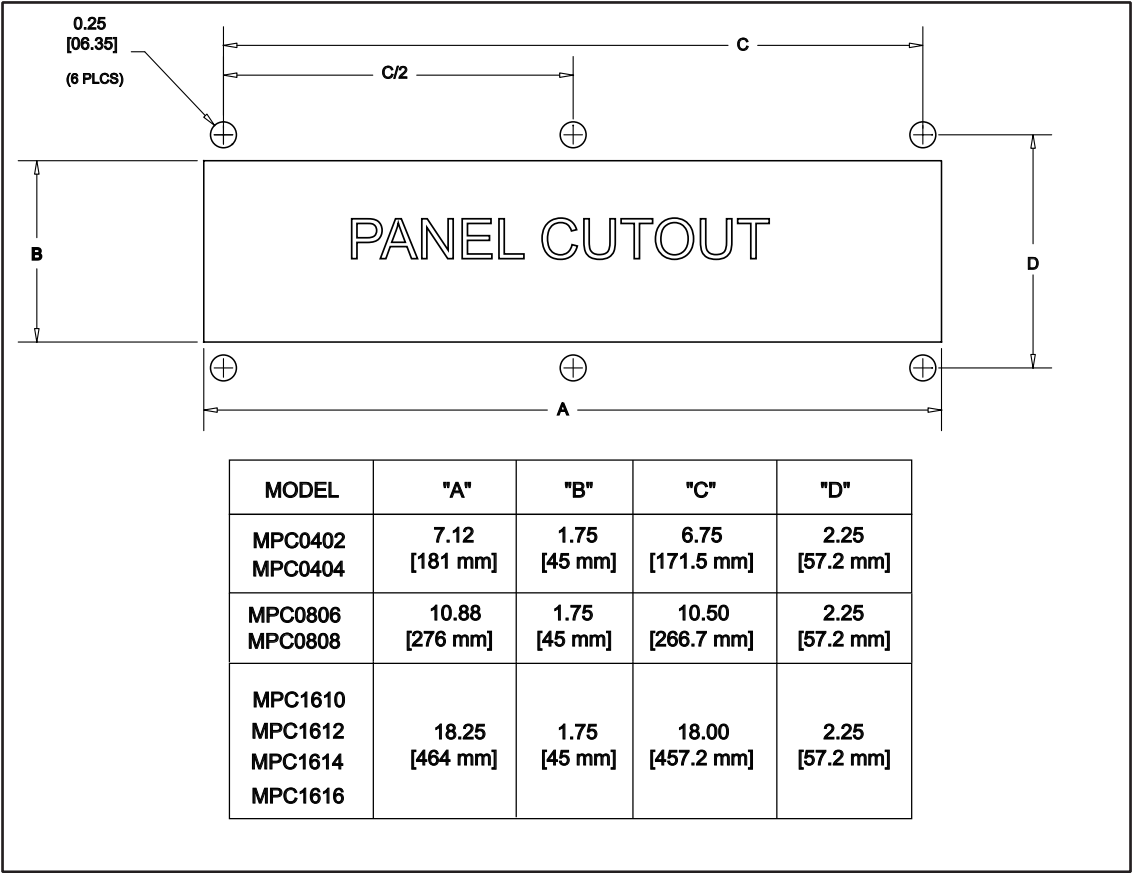


Figure 10-6 MPC Interface Cutout Guide

Continued



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## Connecting Cables

For stand-alone interfaces and securely installed panel mounted interfaces:

### Rear Connections

Refer to Figure 10 -7 below, and complete these connections.

1. Earth ground - Connect one end of a user-supplied 14-Gauge ground wire to the ground connection at the rear of the MPC, **A** in Figure 10 -7. Connect the other end of the wire to an earth ground potential at the electrical box that supplies power to the equipment (or to the equipment enclosure into which your system is installed).
2. U/S (ultrasonic) cable (Dukane P/N 200-479-XX - Order the correct cable length for your installation.) - Connect one end of the cable to the left rear U/S connector of the MPC interface, **B** in Figure 10 -7. The other end of the cable connects to J1 of the ultrasonic generator.
3. MPC Interface cable (Dukane P/N 200-1408-XX - Order the correct cable length for your installation.) - Connect one end of the cable to the right rear MPC Interface connector, **C** in Figure 10 -7. The other end of the cable connects to the MPC INTERFACE connector on the ultrasonic generator.

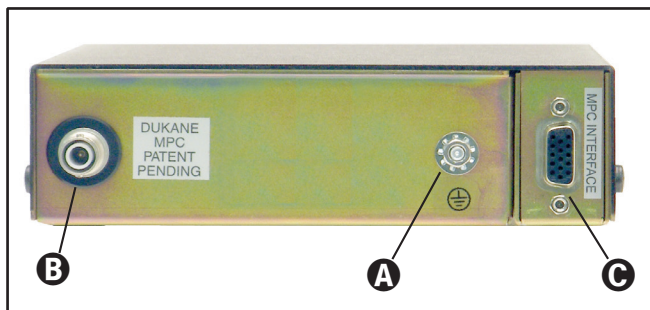


Figure 10-7 MPC Interface Rear Connectors

### Front Connections

Refer to Figure 10 -8 below.

Complete these connections.

1. Probe Cable(s) - Beginning with PROBE 1, connect one end of the cable (See Table 10-IV below.) to the U/S connector on the MPC's front panel, **D** in Figure 10 -7. Connect the other end of the cable to the corresponding probe for your specific welding application.
2. Repeat Step 1 for each of the remaining probes (in sequence: 2, 3, 4, etc.) in your system.

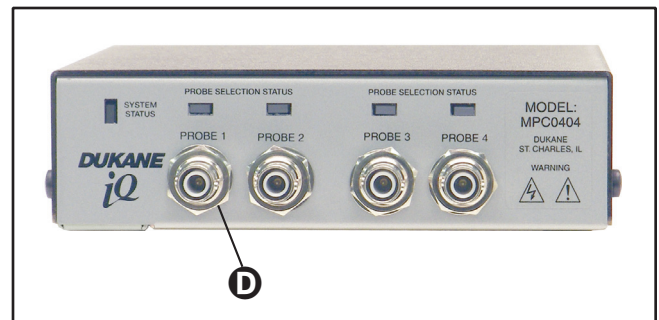


Figure 10-8 MPC Interface Front Connectors

System Frequency	Probe P/N	Cable P/N : MPC to Probe
20kHz	41C25	<b>200-479-XX</b>
	41C27	
30kHz	41A60R-129	<b>200-615-XX</b>
40kHz	41A40	

Table 10-IV Probe Cables

Continued

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## MPC Interface Status LEDs

### System Status

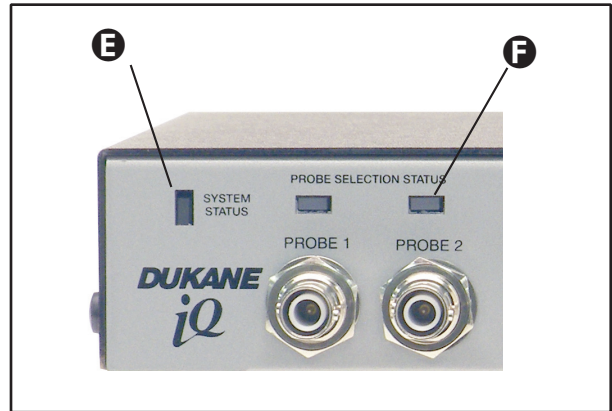
When the system is powered and ready, the front panel **SYSTEM STATUS** LED lights up, and becomes **GREEN** (**E** in Figure 10-9).

*If this LED lights up RED, a hardware fault has been sensed, and the unit should be returned to Dukane for servicing.*

### Probe Selection Status

The **PROBE SELECTION STATUS** LED (**F** in Figure 10-9) lights up **GREEN** indicating it is the selected probe.

A probe's LED turns to **RED** (from **GREEN**) when ultrasonic power is activated.



**Figure 10-9** MPC Interface Status LEDs

*Continued*

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## MPC Cycle Illustration

The flow chart below illustrates a typical welding cycle when the MPC feature is used.

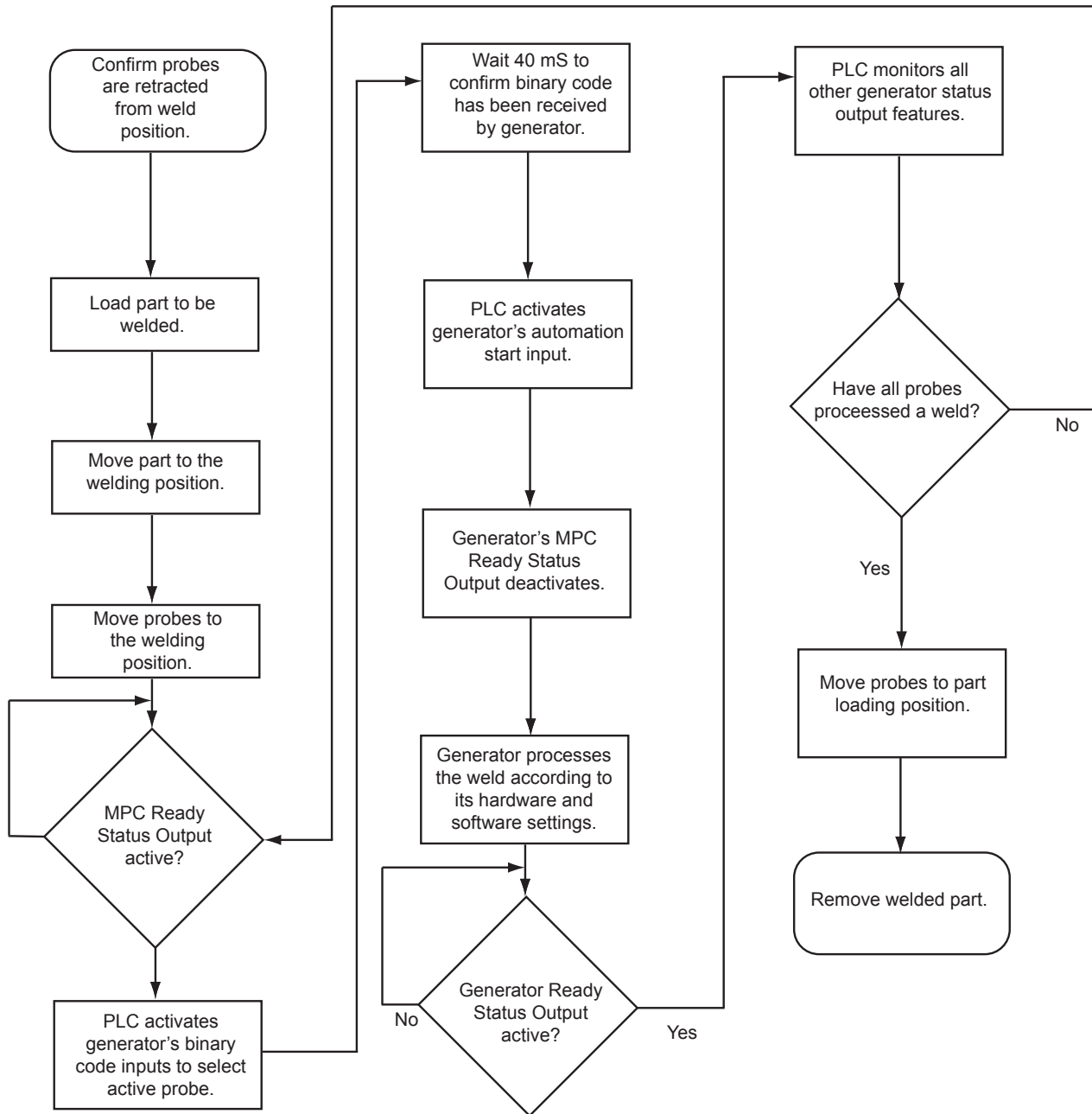


Figure 10-10 MPC Cycle Flow Chart

## Remote Amplitude Control Module

### Part Number - 110-4183

This optional module enables remote control of output amplitude of the *iQ* system. The control interface is a 4–20mA current loop. The current loop connector and fault indicator are shown below in Figure 10-12. The output can be adjusted from 36% to 100%. The scale factor is a 4% amplitude change for each mA change. A graph of amplitude output as a function of loop current is shown in Figure 10-11. The current loop compliance voltage is 6 volts minimum.

Failure to provide at least 4mA of loop current is sensed as a fault and will produce minimum amplitude output.

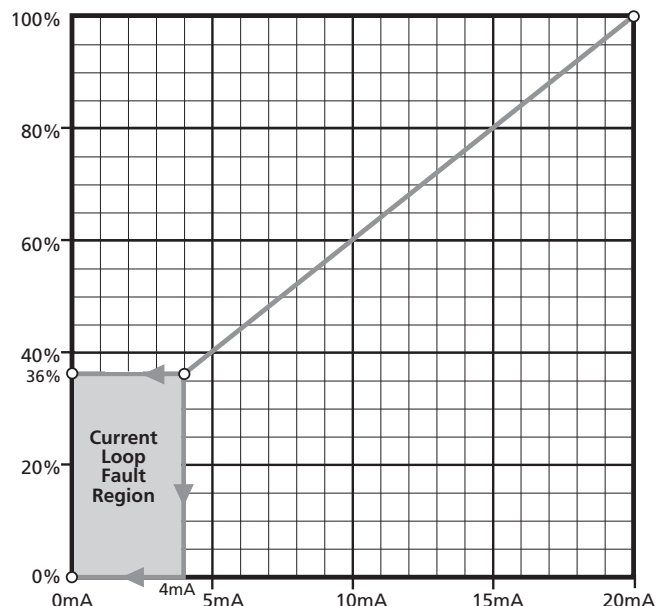
The current loop fault indicator is a bicolor LED. It is GREEN when the current is between 4 and 20mA and RED when the current is below 2mA.

### Current Loop Fault

When a current loop fault is active, the minimum ultrasound output is 36%. If a current loop source is not available, an external +24VDC power supply can be connected to the POS and NEG terminals of J7. (See Figure 10-12.) The +22VDC supply on System Output Pins 1(+) and 3(-) can also be used. Using either of these connections will produce the maximum ultrasound output (100%).

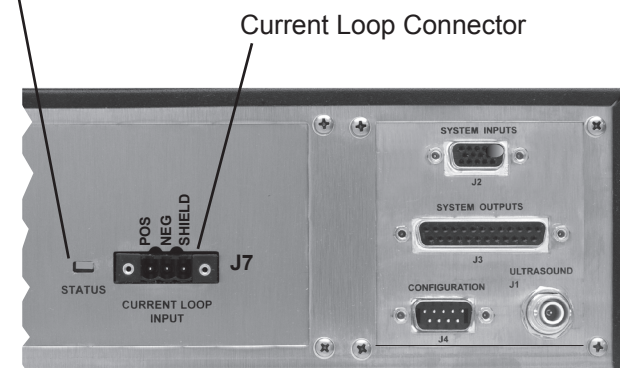
### Menu Selections

With the optional Remote Amplitude Control Module installed, the generator detects the module. As a result there is an additional menu to consider:



**Figure 10-11** Current Loop Transfer Function Graph

### Current Loop Fault Indicator - Green/Red LED



**Figure 10-12** Remote Amplitude Control Module

## Isolated I/O Conversion Module

### Part Number - 110-4397

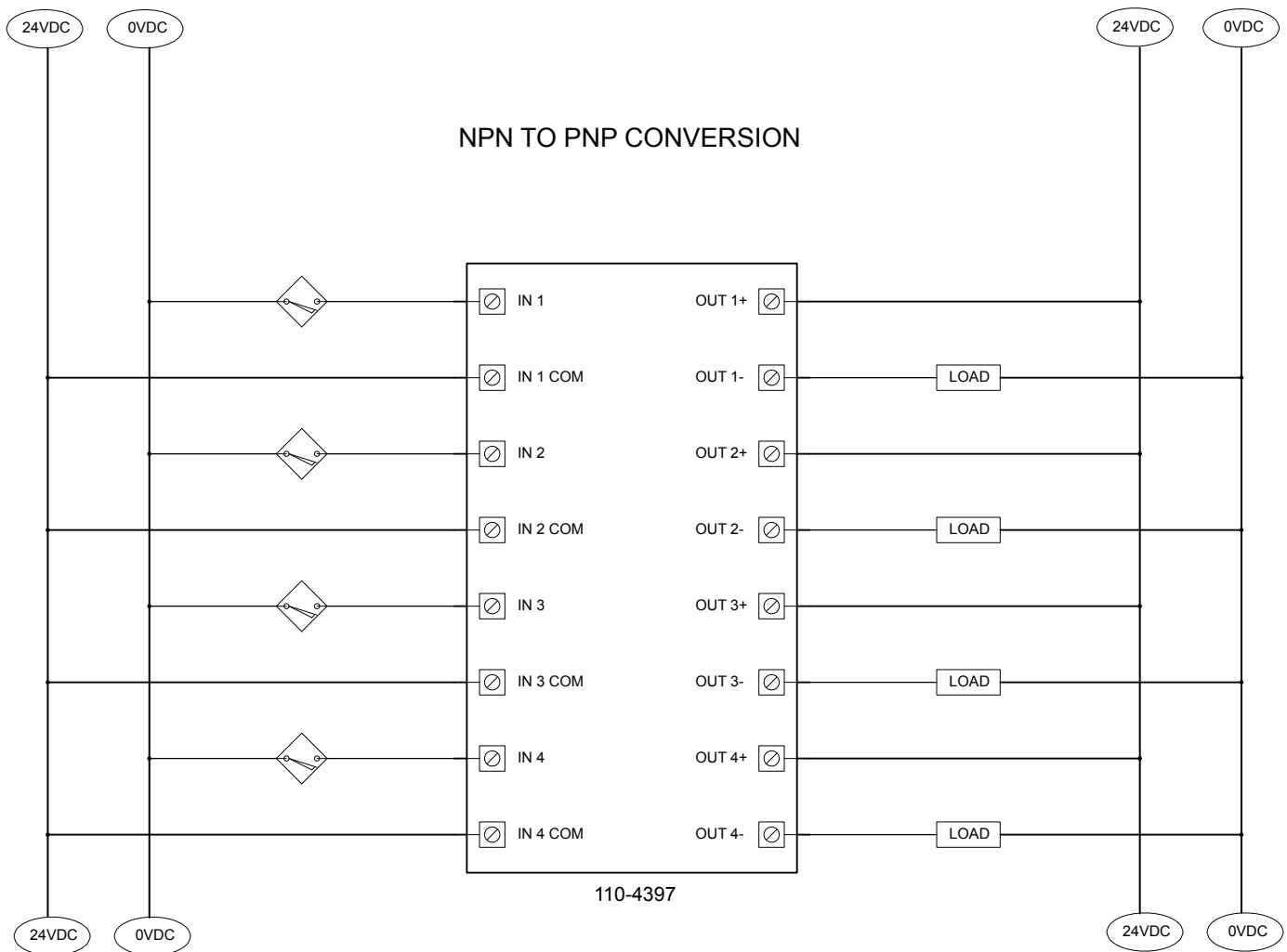
The Isolated I/O Conversion Module is a solid-state, DIN rail-mounted module that can be used to convert an *iQ*'s NPN (sinking) outputs to PNP (sourcing) outputs.

This module should be used in place of relays if the mechanical life of relays in the automated machine is a concern. Each of the four channels are completely isolated from each other and can also be used to convert PNP signals to NPN, or to convert +5V TTL signals to +24V levels.

### Examples

Three examples of conversion possibilities are shown on the pages that follow:

- **NPN to PNP**, Figure 10-13
- **PNP to NPN**, Figure 10-14, and
- **+5V to +24 V PNP**, Figure 10-15



**SPECIFICATIONS:**

**INPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 CURRENT: 1.5mA @ 5.0 Vdc / 9.5mA @ 24.0 Vdc

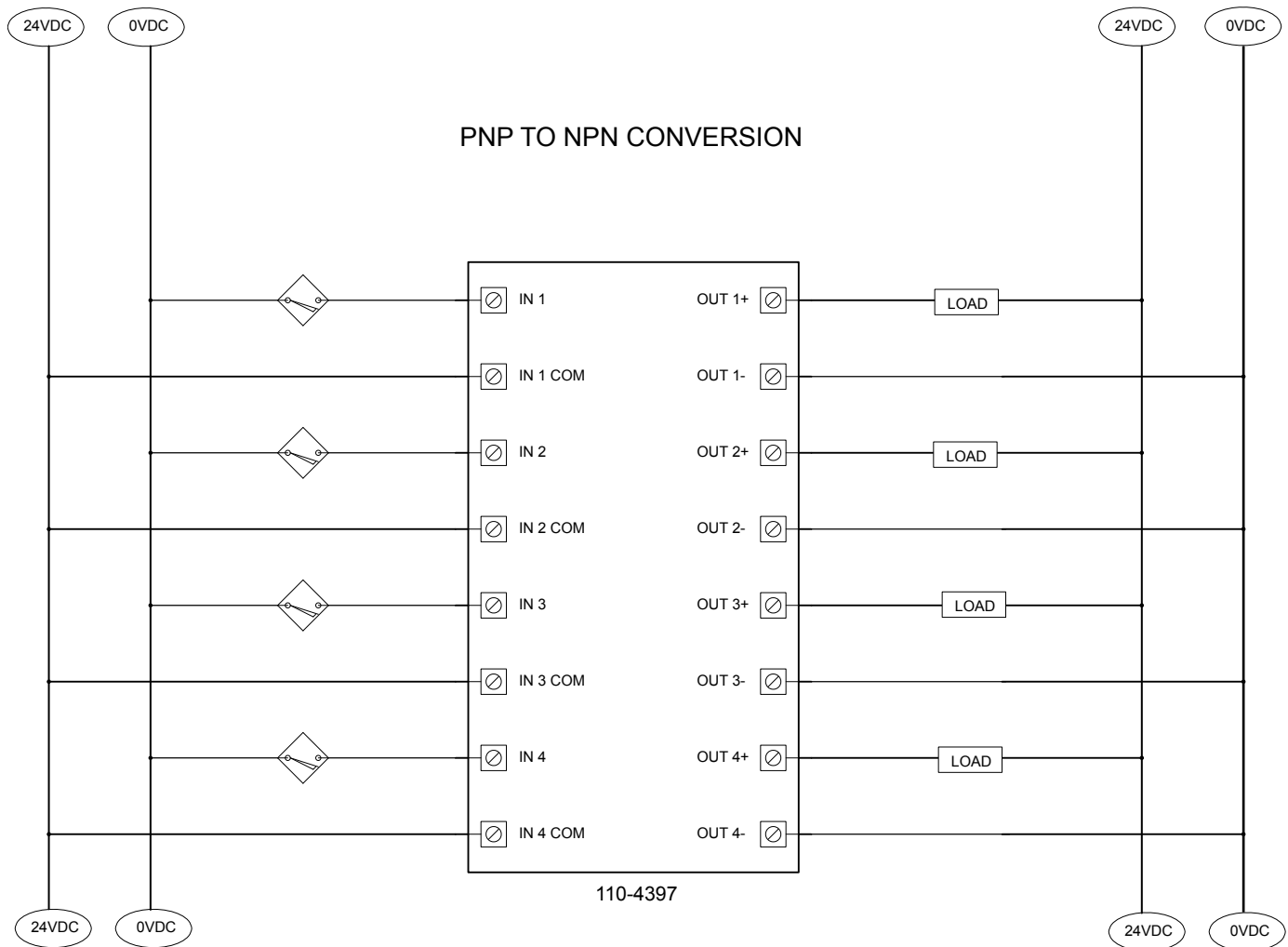
**OUTPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 MAXIMUM CURRENT: 50 mA  
 VOLTAGE DROP ( + TO - ): 1.0 Vdc MAX

**NOTES:**

- 1: OUTPUTS SHOULD NOT BE CONFIGURED TO SINK A TTL LOAD TO GROUND. A RELAY CONNECTION SHOULD BE USED INSTEAD.

**Figure 10-13** NPN to PNP Conversion

**SPECIFICATIONS:****INPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 CURRENT: 1.5mA @ 5.0 Vdc / 9.5mA @ 24.0 Vdc

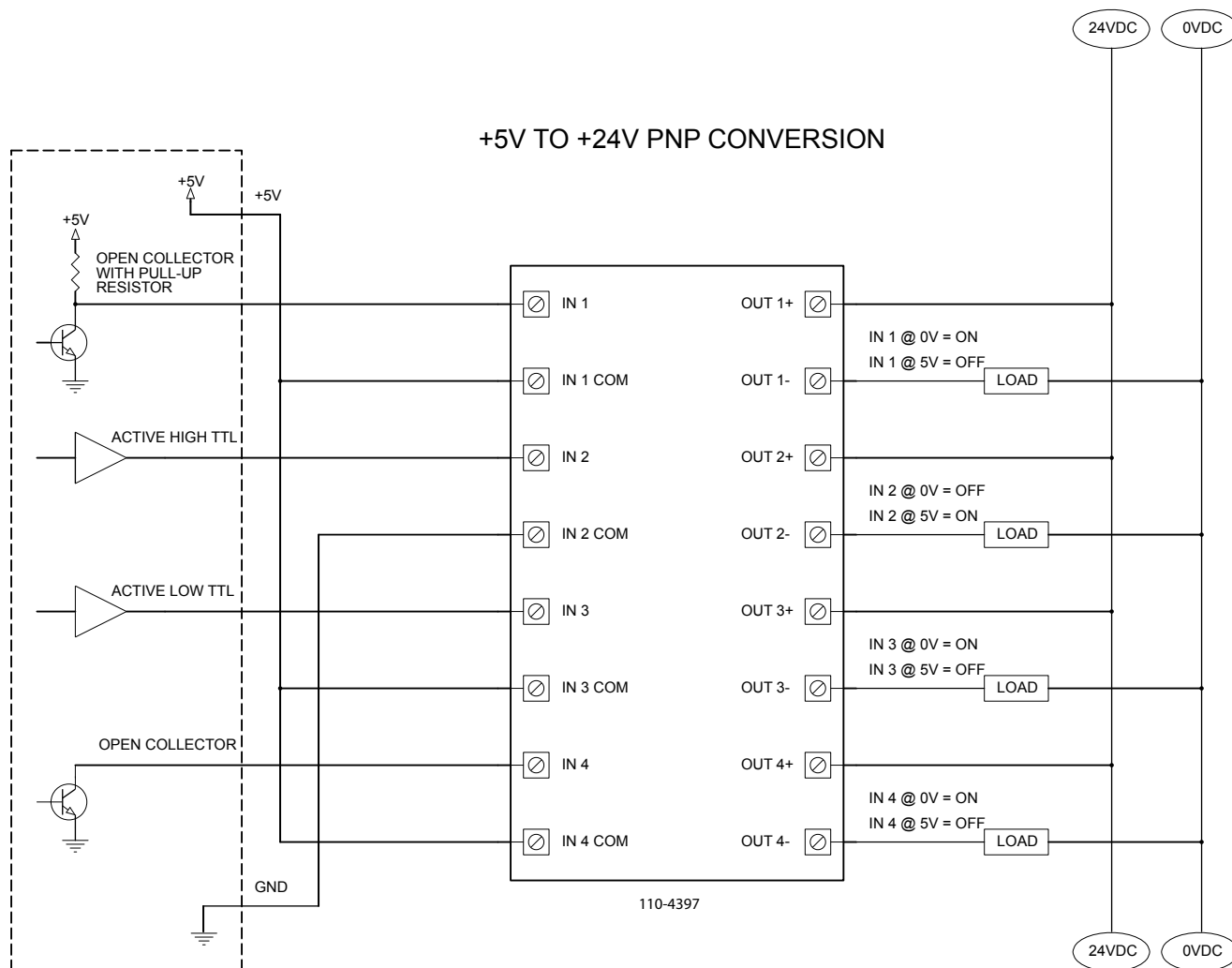
**OUTPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 MAXIMUM CURRENT: 50 mA  
 VOLTAGE DROP ( + TO - ): 1.0 Vdc MAX

**NOTES:**

1: OUTPUTS SHOULD NOT BE CONFIGURED TO SINK A TTL LOAD TO GROUND. A RELAY CONNECTION SHOULD BE USED INSTEAD.

**Figure 10-14** PNP to NPN Conversion



**SPECIFICATIONS:**

**INPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 CURRENT: 1.5mA @ 5.0 Vdc / 9.5mA @ 24.0 Vdc

**OUTPUTS:**

MINIMUM VOLTAGE: 5.0 Vdc  
 MAXIMUM VOLTAGE: 30.0 Vdc  
 MAXIMUM CURRENT: 50 mA  
 VOLTAGE DROP ( + TO - ): 1.0 Vdc MAX

**NOTES:**

- 1: OUTPUTS SHOULD NOT BE CONFIGURED TO SINK A TTL LOAD TO GROUND. A RELAY CONNECTION SHOULD BE USED INSTEAD.

**Figure 10-15** +5V to +24V PNP Conversion





**iQLinQ** communication options allow automated systems to monitor and change settings in **iQ** generators. These options provide machine builders the ability to integrate the generator into an electrical cabinet and to use the machine's HMI to program or monitor weld settings.

All Dukane **iQ** LS generators include the RS-232 Interface option, which can be used to set amplitude and monitor power. Using this option avoids adding expensive analog cards into PLC racks. **iQLinQ** also provides a cost effective solution for adding the Weld by Energy feature that is only available in the more advanced **iQ** generators. In addition to RS-232, **iQLinQ** is also available for PROFIBUS and EtherNet/IP™.

**iQLinQ** solutions are available to provide complete ladder logic and HMI screens that can be dropped into Allen Bradley (RSLogix 5000) and Siemens (Step 7) PLC projects.

Contact your local Dukane representative for more information about the **iQLinQ** options.

### **iQLinQ RS-232 Interface Option**

The RS-232 Interface option allows the **iQ** generator to connect to a PLC's serial port. Each generator requires a dedicated connection to automation, so it is not possible to daisy-chain or bus multiple generators on a single RS-232 connection.

#### **Control Parameters Available via RS-232**

(All **iQ** LS generators)

1. Set these parameters: Amplitude, Ramp Up Time, and Ramp Down Time.
2. Configure advanced hardware settings including Phase, Free Run Frequency, Frequency Lock and Hold, and Frequency Limits.

#### **Parameters that can be Obtained via RS-232 (All **iQ** LS generators)**

1. All parameters that are configured via RS-232.
2. Real time data that includes welder state (ultrasound active or not), frequency, power, and amplitude.

#### **Control Parameters Available via RS-232**

(Time and Energy option)

1. Set weld method to Time, Energy, or Peak Power. Set associated values in seconds, joules, or watts.
2. Set Amplitude, Ramp Up Time, and Ramp Down Time.
3. Enable and set Trigger by Power parameters.
4. Enable and set Hold Time.
5. Enable and set Afterburst delay and duration.
6. Enable checking for Suspect Parts. Set maximum and minimum values for Time, Power and/or Energy.
7. Enable checking for Bad Parts. Set maximum and minimum values for Time, Power and/or Energy.
8. Configure advanced hardware settings including Phase, Free Run Frequency, Frequency Lock and Hold, and Frequency Limits.

#### **Parameters that can be Obtained via RS-232**

(Time and Energy option)

1. All parameters that can be configured via RS-232.
2. Real time data that includes welder state (ultrasound active or not), frequency, power, and amplitude.
3. Weld cycle data from previous weld that includes:
  - Cycle Count
  - Good, Bad, and Suspect Part information
  - Process Limit setting exceeded or not reached if Bad or Suspect Part checking is enabled
  - Weld Time
  - Weld Energy
  - Peak Power

For information on how to control and/or monitor specific parameters, **iQ** Generator RS-232 Communication and Control documentation is available.

Signing a non-disclosure agreement is required to obtain this documentation.

*Continued*

## **iQLinQ™ PROFIBUS Communications Module**

**Part Number - 110-4554**

The PROFIBUS option module allows the **iQ** generator to connect to a PROFIBUS network. Since PROFIBUS is multipoint instead of point-to-point, more than one generator can be connected to a single bus cable. The PROFIBUS module offers access to generator parameter settings and status information listed below. In addition, if desired, all I/O wiring can be replaced with a single PROFIBUS cable.

### **Control Parameters available via PROFIBUS**

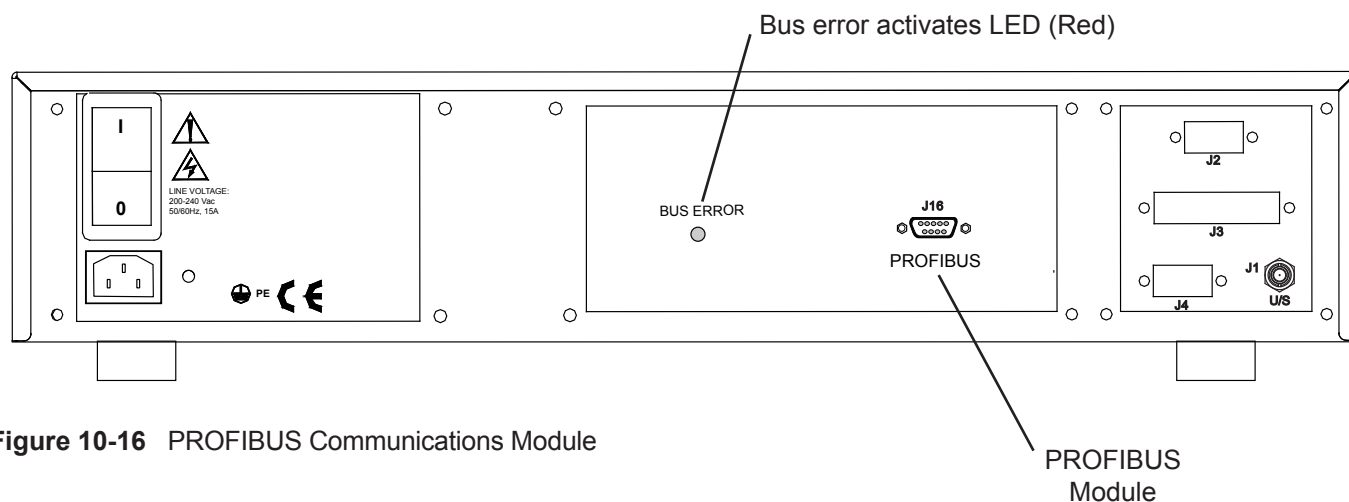
1. Set weld method to Time, Energy, or Peak Power. Set associated values in seconds, joules, or watts.
2. Set Amplitude, Ramp Up Time, and Ramp Down Time.
3. Enable and set Trigger by Power parameters.
4. Enable and set Hold Time.
5. Enable and set Afterburst delay and duration.
6. Enable checking for Suspect Parts. Set maximum and minimum values for Time, Power and/or Energy.
7. Enable checking for Bad Parts. Set maximum and minimum values for Time, Power and/or Energy.
8. Configure advanced hardware settings including Phase, Free Run Frequency, Frequency Lock and Hold, and Frequency limits.

### **Parameters that can be obtained via PROFIBUS**

1. All parameters that can be configured via PROFIBUS.
2. Real time data which includes welder state (ultrasound active or not), frequency, power, and amplitude.
3. Weld cycle data from previous weld which includes:
  - Cycle Count
  - Good, Bad, and Suspect Part information
  - Process Limit setting exceeded or not reached if Bad or Suspect Part checking is enabled
  - Weld Time
  - Weld Energy
  - Peak Power

For information on how to control and/or monitor specific parameters, **iQ** Generator PROFIBUS Communication and Control documentation is available.

Signing a non-disclosure agreement is required to obtain this documentation.



**Figure 10-16** PROFIBUS Communications Module

*Continued*

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**iQLinQ™ Ethernet/IP™ Module****Part Number - 110-4644**

The EtherNet/IP option module allows the **iQ** generator to connect to an EtherNet/IP network. The option module is an external DIN-rail mounted device that acts as a bridge between the automation network and an **iQ** generator's RS-232 port. See Figure 10-17 below.

**Control Parameters available via EtherNet/IP**

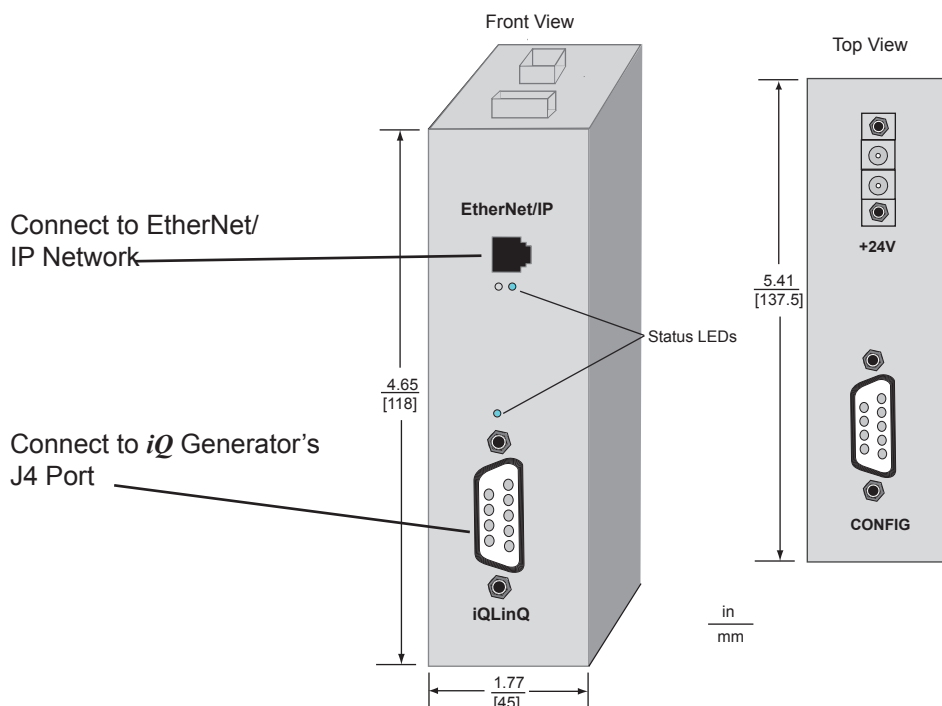
1. Set weld method to Time, Energy, or Peak Power. Set associated value in seconds, joules, or watts.
2. Set Amplitude, Ramp Up Time, and Ramp Down Time.
3. Enable and set Trigger by Power parameters.
4. Enable and set Hold time.
5. Enable and set Afterburst delay and duration.
6. Enable checking for Suspect Parts. Set maximum and minimum values for Time, Power and/or Energy.
7. Enable checking for Bad Parts. Set maximum and minimum values for Time, Power and/or Energy.
8. Configure advanced hardware settings including Phase, Free Run Frequency, Frequency Lock and Hold, and Frequency limits.

**Parameters that can be obtained via Ethernet/IP**

1. All parameters that can be configured via EtherNet/IP.
2. Real time data which includes welder state (ultra-sound active or not), frequency, power, and amplitude.
3. Weld cycle data from previous weld which includes:
  - Cycle Count
  - Good, Bad, and Suspect Part information
  - Process Limit setting exceeded or not reached if Bad or Suspect Part checking is enabled
  - Weld Time
  - Weld Energy
  - Peak Power

For information on how to control and/or monitor specific parameters, **iQ** Generator EtherNet/IP Communication and Control documentation is available.

Signing a non-disclosure agreement is required to obtain this documentation.

**Figure 10-17** EtherNet/IP™ Module

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# SECTION 11

## Specifications

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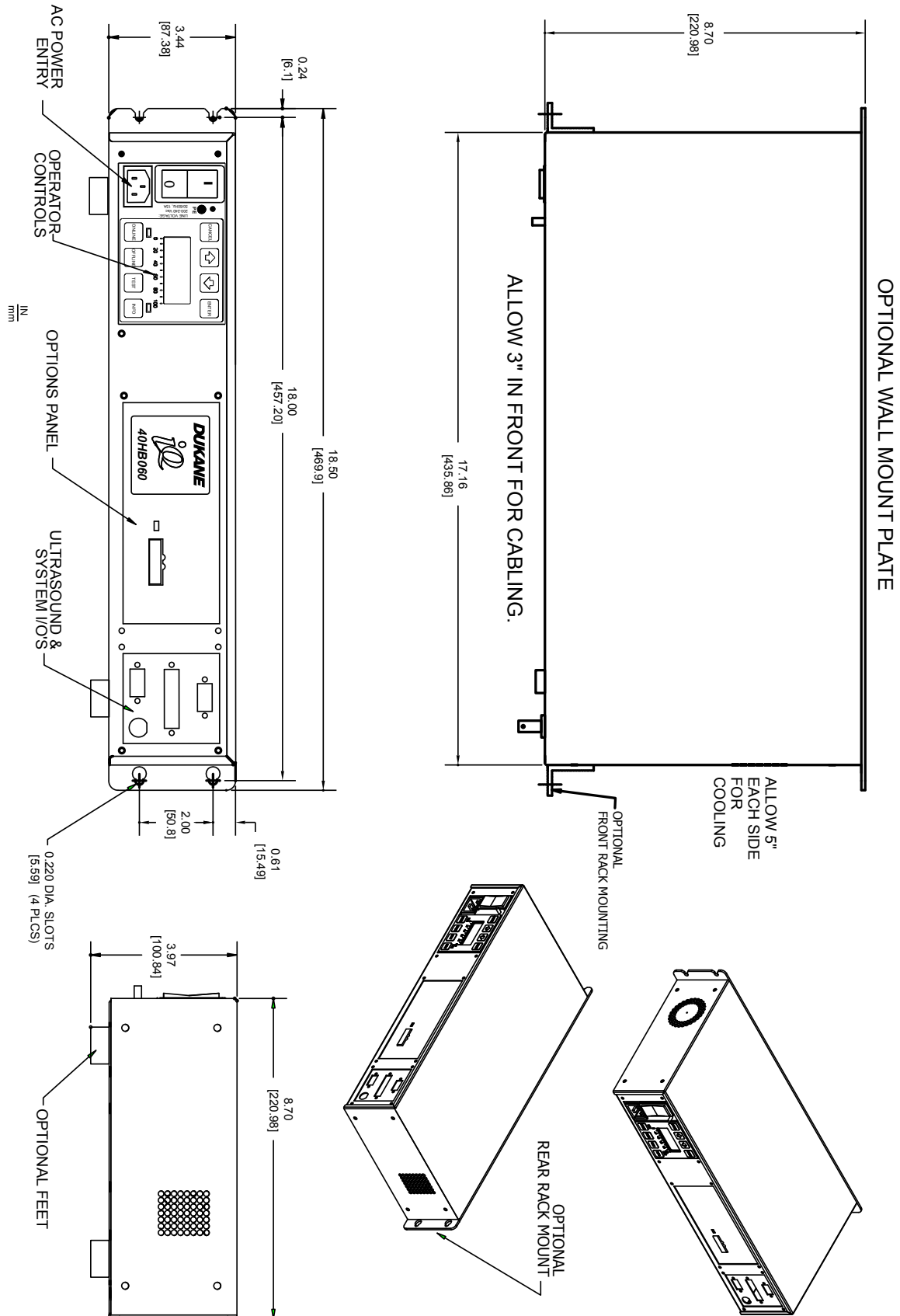


Figure 11-1 Low Profile Chassis Drawing

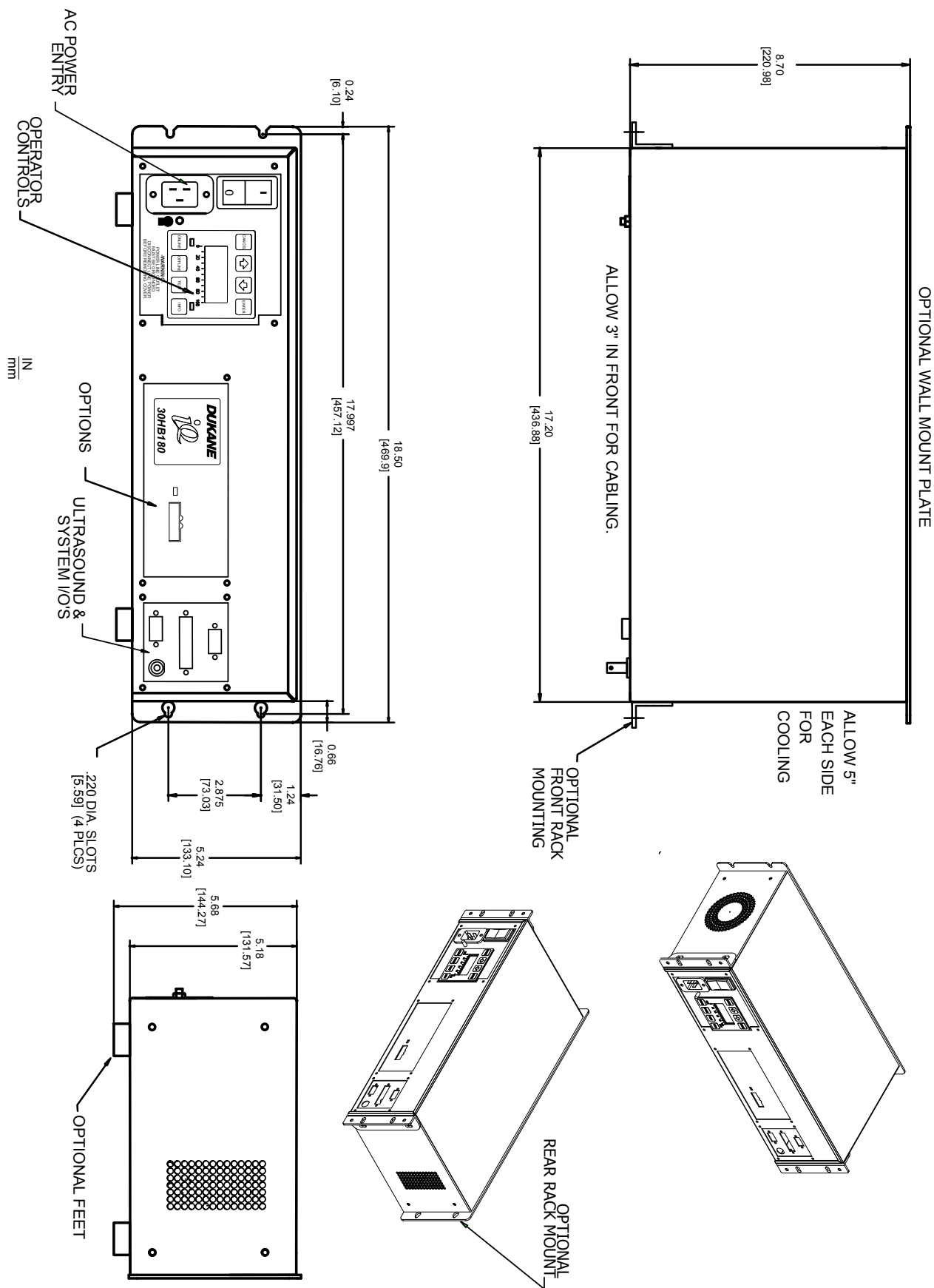


Figure 11-2 High Profile Chassis Drawing



## Weight:

Low Profile Unit:	24 pounds (10.9 kg)
High Profile Unit :	30 pounds (13.6 kg)
Shipping:	Add 5 pounds (2.3 kg) to unit weight for packing materials

## Operating Environment

Operate the generator within these guidelines:

<b>Temperature:</b>	40°F to 100°F (+5°C to +38°C)
<b>Altitude:</b>	15,000 ft (4572 m)
<b>Air Particulates:</b>	Keep the equipment dry. Minimize exposure to moisture, dust, dirt, smoke and mold.
<b>Humidity:</b>	5% to 95% non-condensing @ +5°C to +30°C

Storage guidelines (generator is not operating):

<b>Temperature:</b>	-4°F to 158°F (-20°C to +70°C)
<b>Altitude:</b>	40,000 ft (12,190 m)
<b>Air Particulates:</b>	Keep the equipment dry. Minimize exposure to moisture, dust, dirt, smoke and mold.
<b>Humidity:</b>	5% to 95% non-condensing @ 0°C to +30°C

## AC Power Requirements

The AC input power requirements depend on the frequency and output power rating of the generator. Table 11-I below, lists both the AC requirements (maximum current drawn before overload) and the AC outlet service rating for each model.

Operating Frequency	Generator Model Number	Overload Power Ratings (Watts)	Input AC Power Requirements Nominal AC Volt @ Maximum RMS Current	North America/ Japan AC Outlet Rating
15kHz	15XX360-2X-XX	3600	200-240V 50/60 Hz @ 25 Amps	30 Amps
15kHz	15XX480-2X-XX	4800	200-240V 50/60 Hz @ 30 Amps	
20kHz	20XX120-1X-XX	1200	100-120V 50/60 Hz @ 15 Amps	15 Amps
20kHz	20XX120-2X-XX	1200	200-240V 50/60 Hz @ 8 Amps	
20kHz	20XX180-2X-XX	1800	200-240V 50/60 Hz @ 12 Amps	
20kHz	20XX240-2X-XX	2400	200-240V 50/60 Hz @ 15 Amps	
20kHz	20XX360-2X-XX	3600	200-240V 50/60 Hz @ 25 Amps	30 Amps
20kHz	20XX480-2X-XX	4800	200-240V 50/60 Hz @ 30 Amps	
30kHz	30XX090-1X-XX	900	100-120V 50/60 Hz @ 8 Amps	15 Amps
30kHz	30XX090-2X-XX	900	200-240V 50/60 Hz @ 8 Amps	
30kHz	30XX120-1X-XX	1200	100-120V 50/60 Hz @ 15 Amps	
30kHz	30XX120-2X-XX	1200	200-240V 50/60 Hz @ 8 Amps	
30kHz	30XX180-2X-XX	1800	200-240V 50/60 Hz @ 12 Amps	
40kHz	40XX060-1X-XX	600	100-120V 50/60 Hz @ 8 Amps	
40kHz	40XX060-2X-XX	600	200-240V 50/60 Hz @ 5 Amps	
40kHz	40XX090-1X-XX	900	100-120V 50/60 Hz @ 15 Amps	
40kHz	40XX090-2X-XX	900	200-240V 50/60 Hz @ 8 Amps	
40kHz	40XX120-1X-XX	1200	100-120V 50/60 Hz @ 15 Amps	
40kHz	40XX120-2X-XX	1200	200-240V 50/60 Hz @ 8 Amps	

**Table 11-I** AC Power Requirements

### NOTES:

An X used above in the Model Numbers is a “wildcard” character meaning any valid character code combination. Maximum line current requirement is specified at the minimum nominal AC line voltage and the rated power level. Models rated for 200-240V nominal AC line voltage include an IEC power inlet to attach an international IEC (type) power cord.

A power cord with a domestic three wire grounding plug is included with each standard system (NEMA 6-15P).

Models rated for 200-240V nominal AC line are fully CE compliant for use in Europe or any other country in the world.

Models rated for 200-240V nominal AC line require a 16 Amp grounded AC outlet rating, outside of North America/ Japan.

Models rated for 100-120V nominal AC line are for use in North America or Japan and include a 15 A fixed power cord.

Models with fixed (non-detachable) power cords, include a three wire grounding plug (NEMA 5-15P configuration). These models are fully FCC compliant, but are not usable in European countries and therefore are not CE certified.

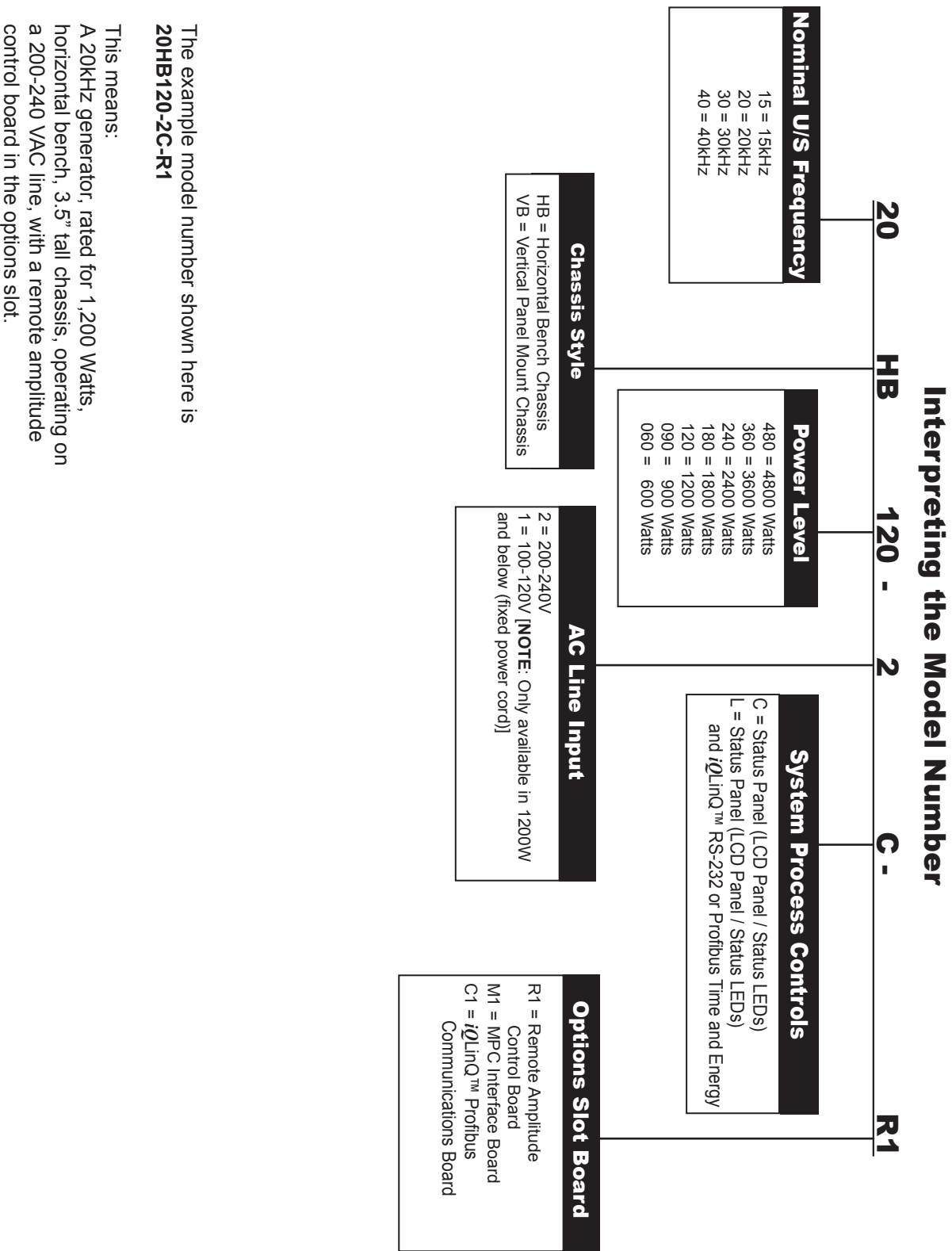


Figure 11-3 Interpreting the Model Number

# Regulatory Agency Compliance

## FCC

The generator complies with the following Federal Communications Commission regulations.

- The limits for FCC measurement procedure MP-5, “Methods of Measurement of Radio Noise Emissions from ISM Equipment”, pursuant to FCC Title 47 Part 18 for Ultrasonic Equipment.

## CE Marking

This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The equipment complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —  
EN 61000-6-4: 2001  
EN 55011: 2003  
EN 61000-6-2: 2005  
EN61000-4-2  
EN61000-4-3  
EN61000-4-4  
EN61000-4-5  
EN61000-4-6  
EN61000-4-8  
EN61000-4-11
- The Low Voltage Directive 2006/95/EC.
- The Machinery Directive 2006/42/EC.  
EN 60204: 2006  
Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirements.

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## IP Rating


The *iQ* generator has an IP (International Protection) rating from the IEC (International Electrotechnical Commission).

The rating is IP2X, in compliance with finger-safe industry standards.

## UL



The *iQ* generator complies with Underwriters Laboratories standard 1012 as verified by TÜV Rheinland, effective January 28, 2013.

**CAUTION**

DO NOT make any modifications to the generator or associated cables as the changes may result in violating one or more regulations under which this equipment is manufactured.

# SECTION 12

## Contacting Dukane

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# Contacting Dukane

## Identify Equipment

When contacting Dukane about a service-related problem, be prepared to give the following information:

- Model number, line voltage and serial number
- Fault/error indicators from the LCD display
- Software version (Press **INFO**. With selection indicators at **System Information**, press **ENTER** to get this data.)
- Problem description and steps taken to resolve it

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

## Intelligent Assembly Solutions

Mailing Address:     Dukane Ultrasonics  
                              2900 Dukane Drive  
                              St. Charles, IL 60174 USA

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Phone:                    (630) 797-4900

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Fax:  
    **Main**                    (630) 797-4949

**Service & Parts**     (630) 584-0796

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E-mail:                    [ussales@dukane.com](mailto:ussales@dukane.com)

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### Website

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature. This is our main web address:

**[www.dukane.com/us/](http://www.dukane.com/us/)**

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You can locate your local representative at:

**[www.dukane.com/us/sales/intsales.htm](http://www.dukane.com/us/sales/intsales.htm)**

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# Dukane ISO

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## ISO CERTIFICATION

Dukane chose to become ISO 9001:2008 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2008 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure.

The ISO 9001:2008 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.



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**Please refer to our website at:**  
***[www.dukane.com/us/sales/intsales.htm](http://www.dukane.com/us/sales/intsales.htm)***  
**to locate your local representative.**

